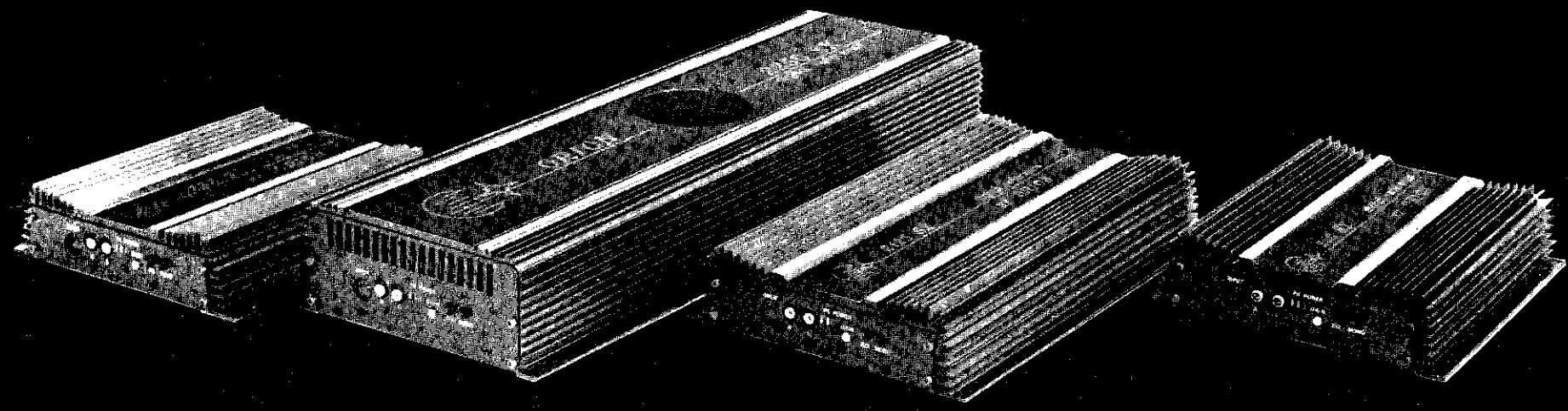
Installation Manual

# ORION Car Audio Power Amplifiers

## Models 222 sx, 250 sx, 2125 sx and 2250 sx



*Built in the U.S.A. from the ground up specifically for high performance car stereo systems*

ORION

When Only The Best Will Do

# INTRODUCTION

You have purchased the finest car audio power amplifier available on the market. The ORION sx series amplifiers really do set new standards for performance and reliability. They are superbly crafted and precision calibrated, and offer the utmost in ease of installation. If you install each amplifier properly with careful attention to all the details covered in this manual, you will be astonished at the quality of sound and you will have an audio system that you can be proud of and enjoy for many years.

- Built in bridging capabilities for summed or mixed mono applications.
- Built in equalization: +15 dB at 40 Hz, -4 dB at 200 Hz, and +6 dB at 10 kHz.
- All ORION amplifiers are built in the U.S.A. from the ground up specifically for high performance car stereo systems.
- All ORION amplifiers and accessories are manufactured to exacting military standards. Extensive testing and burn-in makes for super reliability in even the toughest situations.
- Each amplifier contains a ±15 volt power supply which also services ORION accessories ("phantom power"). This ensures maximum dynamic performance from all accessories while maintaining optimum ground isolation to minimize potential engine noise. Power supplies protected against low voltage or excessive current.
- Variable input sensitivity (gain adjust) allows use with most radios and decks. Single input gain adjust for balanced channel levels. Left and right peak indicator lights to indicate clipping.
- Optically isolated remote turn-on circuit isolates the radio or deck from the amplifier.
- FET switched 40 dB audio attenuator reducts turn-on/turn-off "thump".
- Parallel RCA and DIN inputs provide considerable versatility for interconnections.
- 6 Hz rumble filter built in for no dc offset.
- A wide variety of accessories are available for flexibility in designing overall audio systems (refer to page 7).

This manual covers the following ORION sx amplifiers:

222 sx (refer to page 3)

250 sx (refer to page 4)

2125 sx (refer to page 5)

2250 sx (refer to page 6)

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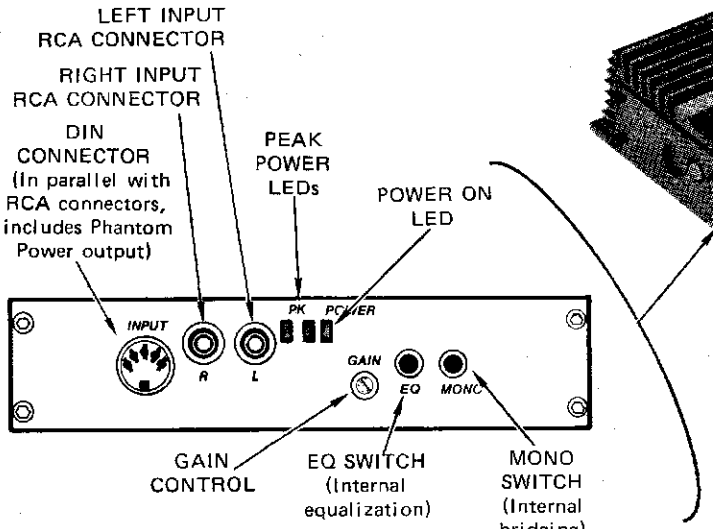
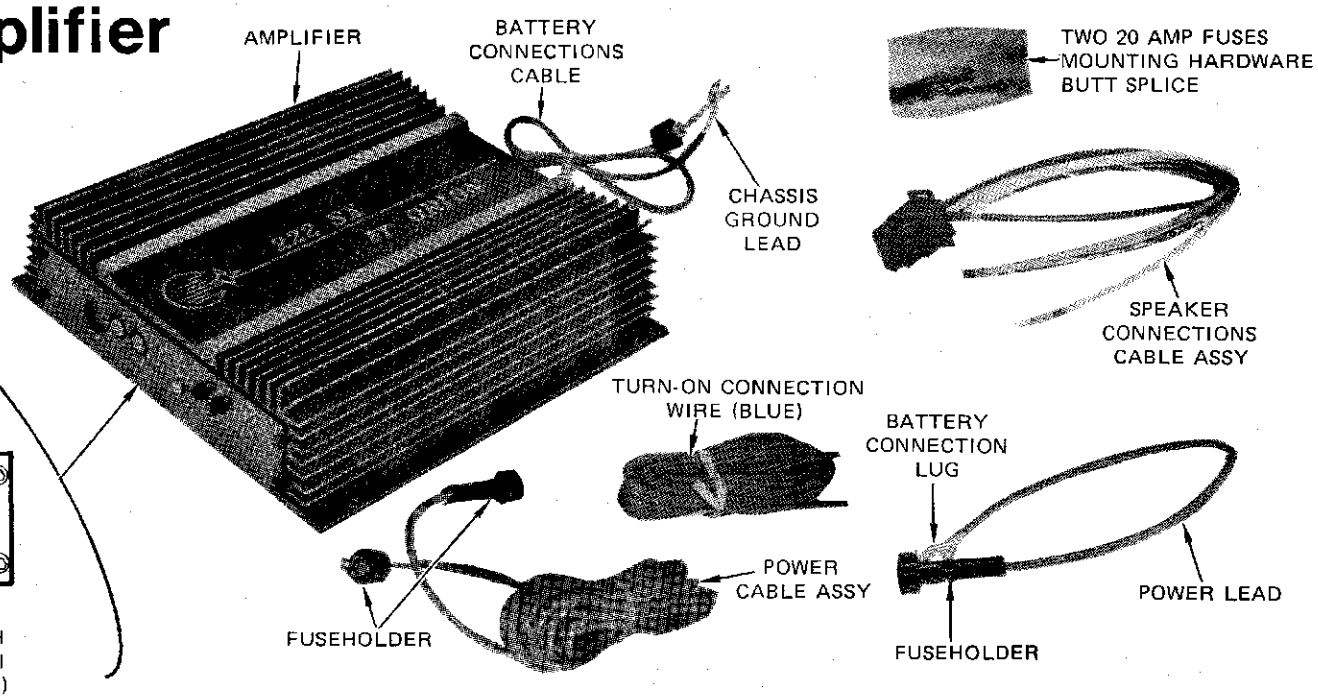
# ORION 222 sx
# Stereo Power Amplifier
# 44 Watts RMS




## EQUIPMENT SUPPLIED




## DESCRIPTION

The ORION 222 sx is a stereo power amplifier that provides 22 watts per channel and is ideal for use in a basic single amplifier system. In customized systems, the 222 sx can be used to drive tweeters and mid-range speakers in multiple amplifier applications.

The amplifier includes switchable built-in equalization — +15 dB at 40 Hz to boost the bass, -4 dB at 200 Hz to take away the mid-bass boom between subwoofers and mid-range speakers, and +6 dB at 10 kHz to accent the high frequencies for a livelier sound.

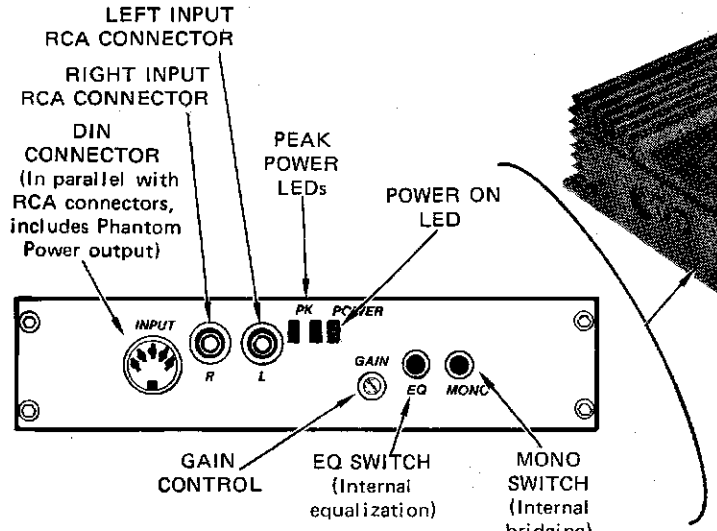
The amplifier also includes built-in bridging capabilities for summed or mono applications (refer to the discussion on bridging on page 10).

The power supplies are protected against low voltage or excessive current (refer to discussion on page 25). A POWER ON indicator light is provided. Also provided are left and right peak indicator lights to indicate clipping.

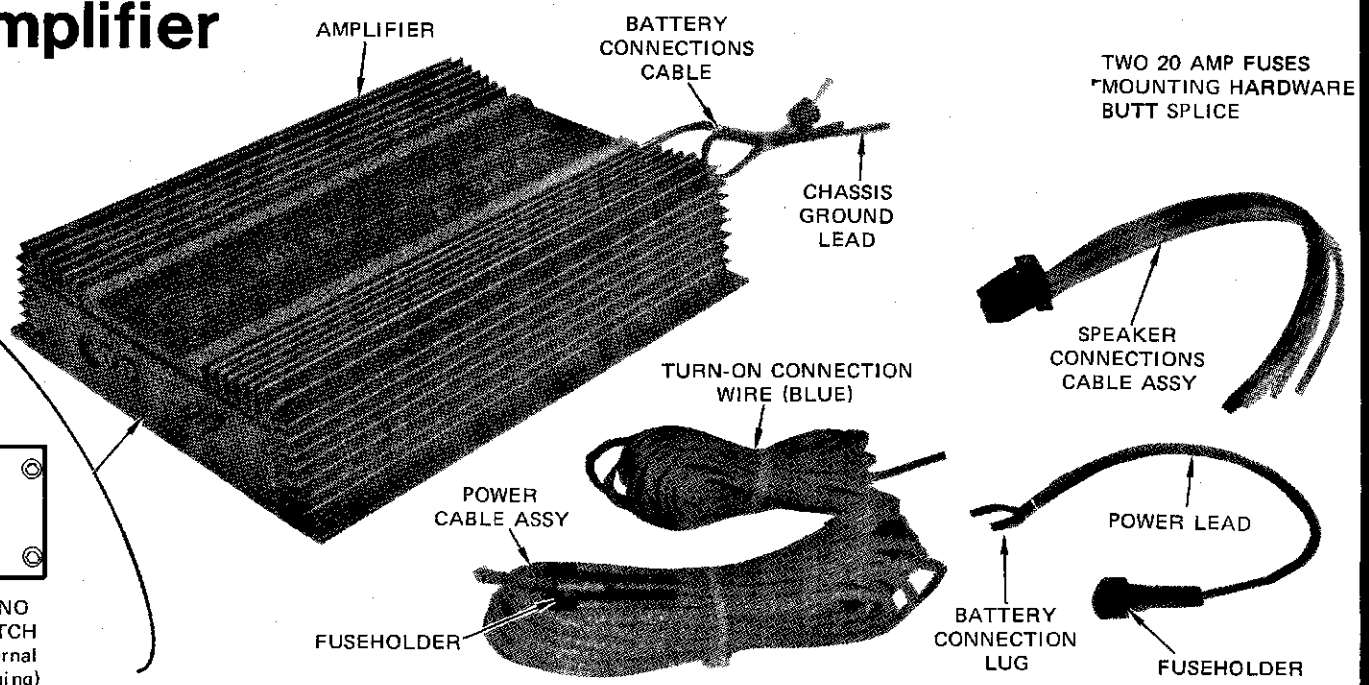
## SPECIFICATIONS

| | |
|---|---|
| **Output Power Per Channel with both channels driven into 4 ohms @ 12 VDC** | 22 watts RMS |
| **Total Harmonic Distortion:** | |
| Typical | 0.005% |
| Maximum | 0.03% |
| **Frequency Response** | 10 Hz to 20 kHz ±0.5 dB |
| **Signal to Noise Ratio** | Better than 100 dB |
| **Channel Separation** | Better than 80 dB |
| **Input Sensitivity** | 150 mV to 5 Vrms |
| **Output Impedance** | 2 to 16 ohms |
| **Input Impedance** | 10K ohms |
| **Remote Turn-on Current** | 50 mA |
| **Current Consumption:** | |
| @ No Signal | 1 amp |
| @ Maximum Output | 8 amps |
| **Voltage Requirements** | 10V to 16V |
| **Damping Factor** | Greater than 500 |
| **Output Section Slew Rate** | 30V per microsecond |
| **Overall Dimensions** | 8.5 x 8.5 x 2.25 inches |

# ORION 250 sx
# Stereo Power Amplifier
# 100 Watts RMS




## EQUIPMENT SUPPLIED




## DESCRIPTION

The ORION 250 sx is a stereo power amplifier that provides 50 watts per channel. It is an excellent choice for easy listening systems where you want full range with smooth highs and rich, tight bass. This amplifier is also ideal for handling tweeters and mid-range speakers in competition systems.

The amplifier includes switchable built-in equalization — +15 dB at 40 Hz to boost the bass, -4 dB at 200 Hz to take away the mid-bass boom between subwoofers and mid-range speakers, and +6 dB at 10 kHz to accent the high frequencies for a livelier sound.

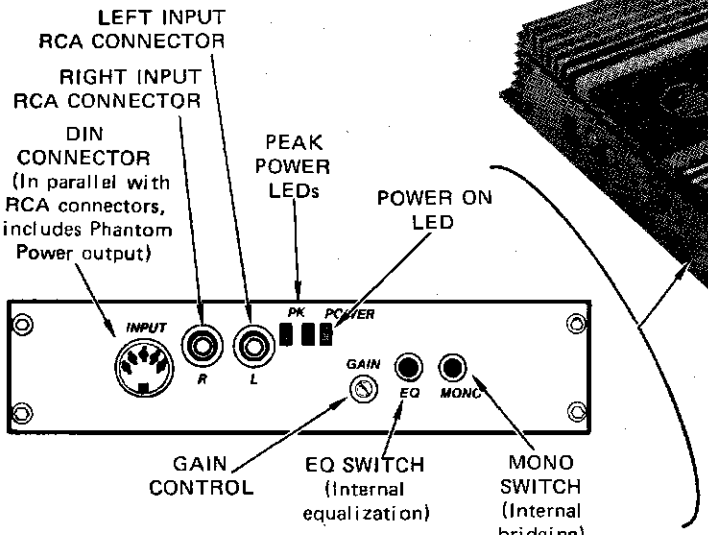
The amplifier also includes built-in bridging capabilities for summed or mono applications (refer to the discussion on bridging on page 10).

The power supplies are protected against low voltage or excessive current (refer to discussion on page 25). A POWER ON indicator light is provided. Also provided are left and right peak indicator lights to indicate clipping.

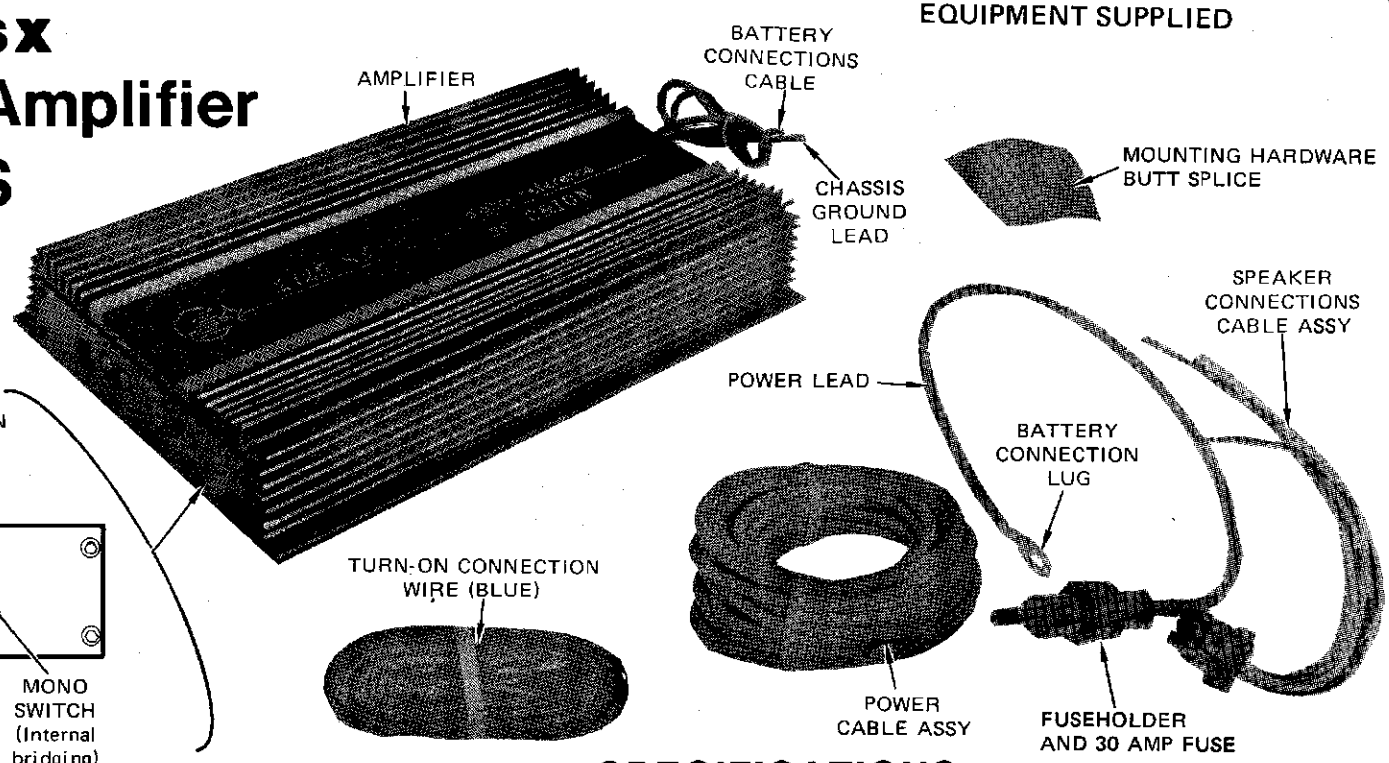
## SPECIFICATIONS

| | |
|---|---|
| **Output Power Per Channel with both channels driven into 4 ohms @ 12 VDC** | 50 watts RMS |
| **Total Harmonic Distortion:** | |
| Typical | 0.005% |
| Maximum | 0.03% |
| **Frequency Response** | 10 Hz to 20 kHz ±0.5 dB |
| **Signal to Noise Ratio** | Better than 100 dB |
| **Channel Separation** | Better than 80 dB |
| **Input Sensitivity** | 150 mV to 5 Vrms |
| **Output Impedance** | 2 to 16 ohms |
| **Input Impedance** | 10K ohms |
| **Remote Turn-on Current** | 50 mA |
| **Current Consumption:** | |
| @ No Signal | 1 amp |
| @ Maximum Output | 20 amps |
| **Voltage Requirements** | 10V to 16V |
| **Damping Factor** | Greater than 500 |
| **Output Section Slew Rate** | 30V per microsecond |
| **Overall Dimensions** | 10 x 8.5 x 2.25 inches |

# ORION 2125 sx
# Stereo Power Amplifier
# 250 Watts RMS




## EQUIPMENT SUPPLIED




## DESCRIPTION

The ORION 2125 sx is a stereo power amplifier that provides 125 watts per channel. It has been designed for use in serious competition systems. In the bridging mode, this amplifier will deliver 500 watts bridged at 4 ohms.

The amplifier includes switchable built-in equalization — +15 dB at 40 Hz to boost the bass, -4 dB at 200 Hz to take away the mid-bass boom between subwoofers and mid-range speakers, and +6 dB at 10 kHz to accent the high frequencies for a livelier sound.

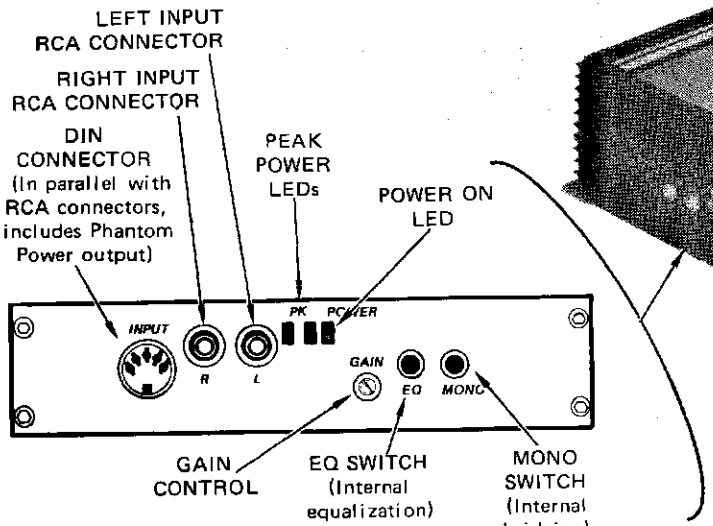
The amplifier also includes built-in bridging capabilities for summed or mono applications (refer to the discussion on bridging on page 10).

The power supplies are protected against low voltage or excessive current (refer to discussion on page 25). A POWER ON indicator light is provided. Also provided are left and right peak indicator lights to indicate clipping.

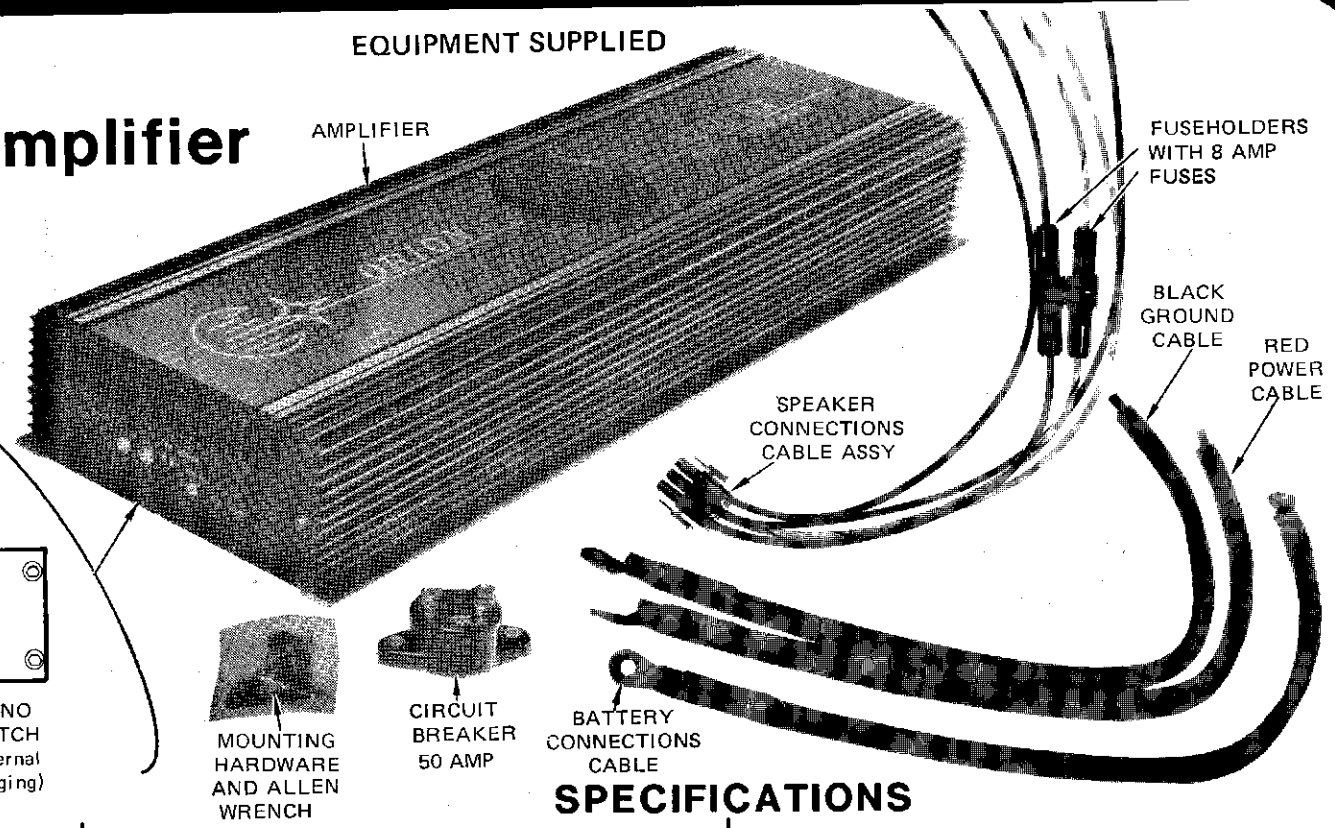
## SPECIFICATIONS

| | |
|---|---|
| **Output Power Per Channel with both channels driven into 4 ohms @ 12 VDC** | 125 watts RMS |
| **Total Harmonic Distortion:** | |
| Typical | 0.005% |
| Maximum | 0.03% |
| **Frequency Response** | 10 Hz to 20 kHz ±0.5 dB |
| **Signal to Noise Ratio** | Better than 100 dB |
| **Channel Separation** | Better than 80 dB |
| **Input Sensitivity** | 150 mV to 5 Vrms |
| **Output Impedance** | 2 to 16 ohms |
| **Input Impedance** | 10K ohms |
| **Remote Turn-on Current** | 50 mA |
| **Current Consumption:** | |
| @ No Signal | 1 amp |
| @ Maximum Output | 40 amps |
| **Voltage Requirements** | 10V to 16V |
| **Damping Factor** | Greater than 500 |
| **Output Section Slew Rate** | 30V per microsecond |
| **Overall Dimensions** | 14 x 8.5 x 2.25 inches |

# ORION 2250 sx
# Stereo Power Amplifier
# 500 Watts RMS




## EQUIPMENT SUPPLIED




## DESCRIPTION

The ORION 2250 sx is a stereo power amplifier that provides 250 watts per channel. It has been designed for use in serious competition systems. In the bridging mode, this amplifier will deliver 1000 watts at 4 ohms.

The amplifier includes switchable built-in equalization — +15 dB at 40 Hz to boost the bass, -4 dB at 200 Hz to take away the mid-bass boom between subwoofers and mid-range speakers, and +6 dB at 10 kHz to accent the high frequencies for a livelier sound.

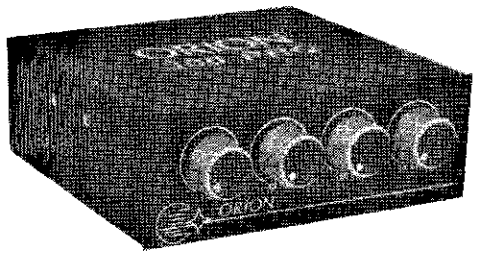
The amplifier also includes built-in bridging capabilities for summed or mono applications (refer to the discussion on bridging on page 10).

The power supplies are protected against low voltage or excessive current (refer to discussion on page 25). A POWER ON indicator light is provided. Also provided are left and right peak indicator lights to indicate clipping.

## SPECIFICATIONS

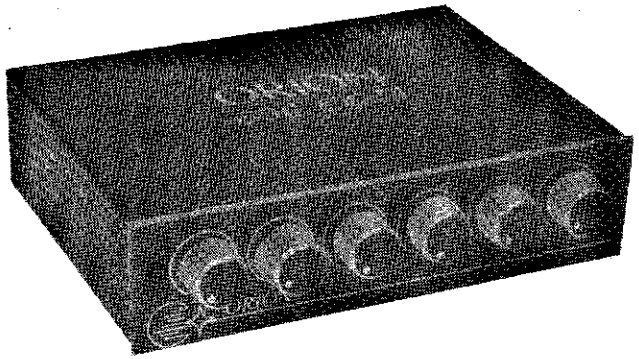
| | |
|---|---|
| Output Power Per Channel with both channels driven into 4 ohms @ 12 VDC | 250 watts RMS @ 4 ohms |
| Total Harmonic Distortion: | |
| Typical | 0.005% |
| Maximum | 0.03% |
| Frequency Response | 10 Hz to 20 kHz ± 0.5 dB |
| Signal to Noise Ratio | Better than 100 dB |
| Channel Separation | Better than 80 dB |
| Input Sensitivity | 150 mV to 5 Vrms |
| Output Impedance | 2 to 16 ohms |
| Input Impedance | 10K ohms |
| Remote Turn-on Current | 50 mA |
| Current Consumption: | |
| @ No Signal | 2.2 amps |
| @ Maximum Output | 120 amps |
| Voltage Requirements | 10V to 16V |
| Damping Factor | Greater than 500 |
| Output Section Slew Rate | 30V per microsecond |
| Overall Dimensions | 23 x 8 x 3 inches |

# ORION ACCESSORIES



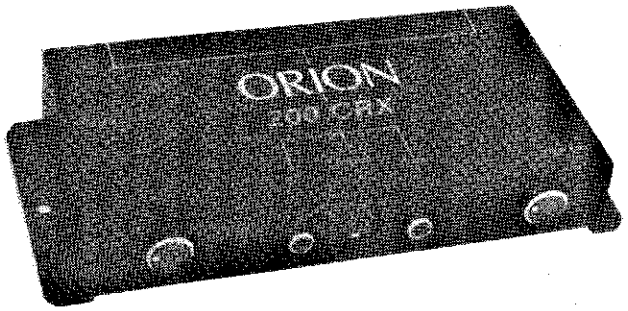
## 300 PRQ PRE-AMPLIFIER EQUALIZER

The ORION 300 PRQ provides pre-amplification plus three bands of equalization (40 Hz cut and boost, 180 Hz cut and boost, and 15 kHz cut and boost). Designed primarily to help compensate for speaker deficiencies, eliminate distortion, and boost range. Input is independently adjustable from 30 mV to 3V RMS. Includes a high-quality volume control. Powered by "phantom power" provided by any ORION amplifier or an ORION PPS 100 Phantom Power Supply.



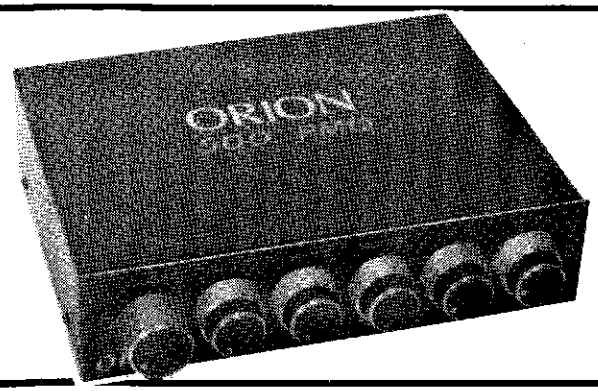
## 600 EQM EQUALIZER MODULE

Audiophile grade equalization for well set-up car audio systems. Features high quality, troublefree rotary controls. The 600 EQM provides six equalization points (30 Hz, 90 Hz, 180 Hz, 2 kHz, 5 kHz, and 15 kHz. Input sensitivity is adjustable. Powered by "phantom power" provided by any ORION amplifier or an ORION PPS 100 Phantom Power Supply.




## 200 CRX ACTIVE CROSSOVER

The ORION 200 CRX is a highly efficient, continuously adjustable, 12 dB per octave, 2-way crossover. Designed for use in multi-amplifier systems with some amplifiers dedicated to the low frequencies and some amplifiers dedicated to the high and midrange frequencies. Independent adjustment of low pass and high pass frequencies from 50 Hz to 5 kHz. Total frequency response is 10 Hz to 50 kHz. Extremely versatile—capable of driving up to 20 amplifiers. "Phantom power" is supplied by any ORION amplifier or by an ORION PPS 100 Phantom Power Supply.

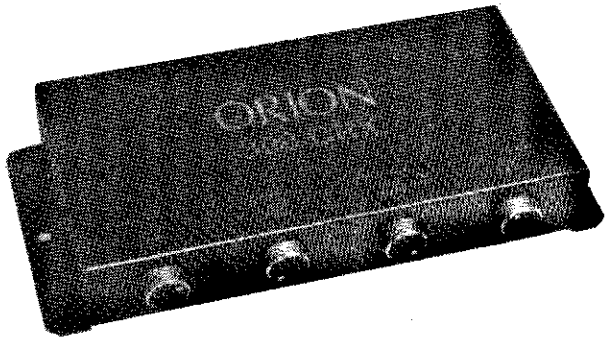



## 500 PMQ PARAMETRIC EQUALIZER

Outstanding flexibility. Allows you to change the frequency of boost and cut. The ORION 500 PMQ Parametric Equalizer features five dual controls—outer knob for selecting the frequency band, and an inner knob for controlling boost or cut for each band. Frequency bands are 30 to 75 Hz, 50 to 150 Hz, 500 to 1.5 kHz, 1.5 to 5 kHz, and 5 to 15 kHz. Boost and cut for each frequency band is 10 dB up or 10 dB down. The EQ curve is fixed. Includes a high-quality volume control. Gain adjustment is 30 mV to 3V RMS. Powered by "phantom power".

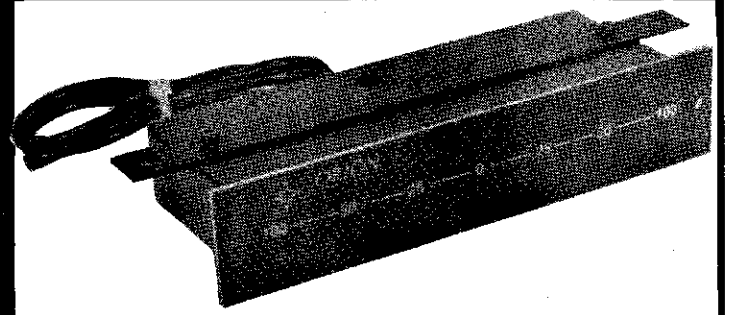
## 300 CRX 3-WAY ACTIVE CROSSOVER

The ORION 300 CRX is a versatile 12 dB per octave 3-way crossover. Designed for use in multi-amplifier systems with some amplifiers dedicated to only the high frequencies, some amplifiers dedicated to only the midrange frequencies, and some amplifiers dedicated to only the low frequencies. Crossover frequencies are continously adjustable between 50 Hz and 5 kHz on all bands. Total frequency response is 10 Hz to 50 kHz. "Phantom power" is supplied by any ORION amplifier or by an ORION PPS 100 Phantom Power Supply.



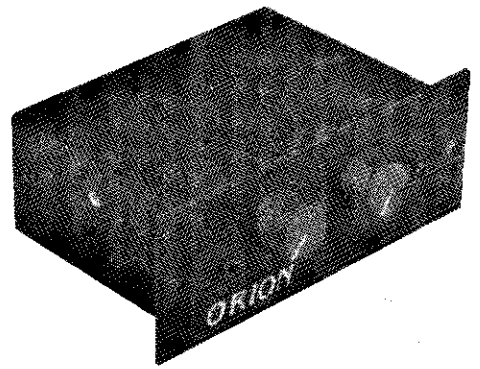
### 30 DBLP LOW PASS FILTER and 30 DBHP HIGH PASS FILTER

When you want pure sound, add a 30 DBLP Low Pass Filter or a 30 DBHP High Pass Filter (or both) to your system. 30 dB per octave low pass or high pass. Cutoff frequency from 48 Hz to 6 kHz through the use of two plug-in chips. The 30 DBLP Low Pass Filter is used to keep the midrange and high frequencies out of your subwoofers, correct for mismatched speakers, eliminate speaker box resonance problems, and remove distortion. The 30 DBHP High Pass Filter is used to make your tweeters sound more lively. Isolated audio ground to prevent audio ground loops and eliminate engine noise. Powered by any ORION amplifier or an ORION PPS 100 Phantom Power supply.



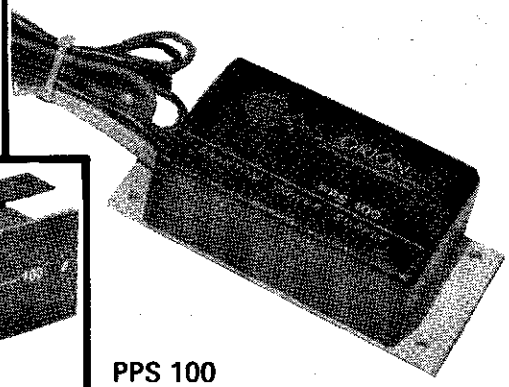
### 100 LED DISPLAY

Ideal for input monitoring to avoid overdriving. 12V dual 10 segment display. Continuously adjustable for fine tuning. Does not add audio distortion in the signal path. Can be mounted under the dash or in the dash.




### 200 DAB DUAL AMP BALANCER

The ORION 200 DAB Dual Amp Balancer allows individual level adjust for multi-amplifier use. You can crank up the front speakers and tone down the rear speakers, or the other way around. For use with decks and radios with or without fader controls. A switch is provided on the rear of the unit for selecting dual or single input terminations. No operating power required.



### PPS 100 PHANTOM POWER SUPPLY

Provides +15 and -15V dc phantom power for use with all ORION accessories. DIN and RCA output connectors. Remote turn on wire. Pulls minimal current so is not a factor in overall power usage for audio system.



## ORION CABLE ASSEMBLIES

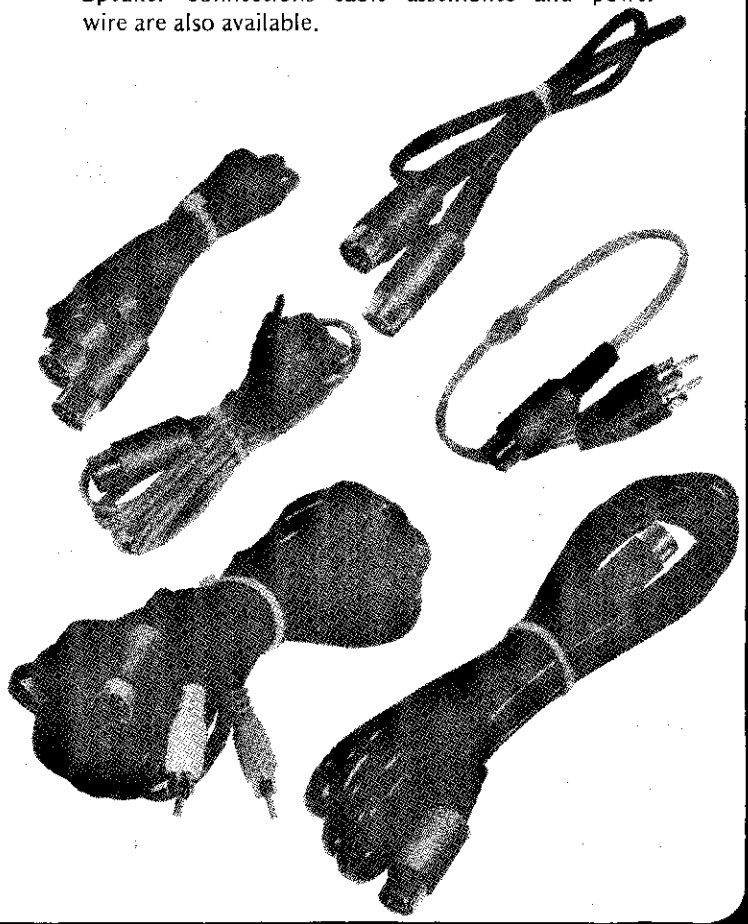
A large variety of top quality ORION cable assemblies are available through your dealer, as follows:

5 PIN DIN TO DIN
Lengths: 6 inches, 1, 2, 3, 4, 5, 6, 10 and 20 feet

5 PIN DIN TO RCA
Lengths: 1, 2, 4, 10 and 20 feet

Order by description. Prices are reasonable and cable assemblies are shipped the same day the order is received.

Speaker connections cable assemblies and power wire are also available.



# PLANNING YOUR CAR AUDIO SYSTEM

It is important that you decide what you are trying to achieve. Car audio systems can vary from merely upgrading your existing factory installation to multi-amplifier systems that include external equalizers, crossover modules, low pass filters, high pass filters, and a variety of speakers. This section contains the simple approaches to audio system design to the very complex. By studying the diagrams, you will see that you can start with a relatively simple system that can gradually grow by adding accessories and additional amplifiers.

## A. USING EXISTING SPEAKERS

If you want a good performance system without having to install special speakers in your car, a single 222 sx or 250 sx will do an excellent job for you. The built-in equalization should noticeably improve the overall sound. A basic single amplifier system is shown in figure 1.

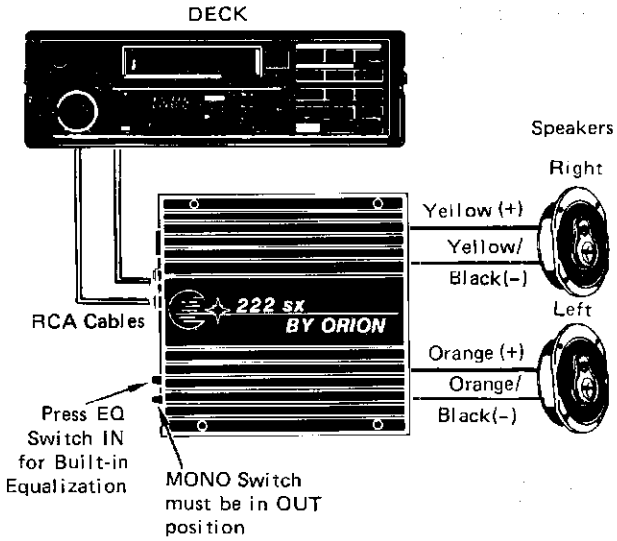
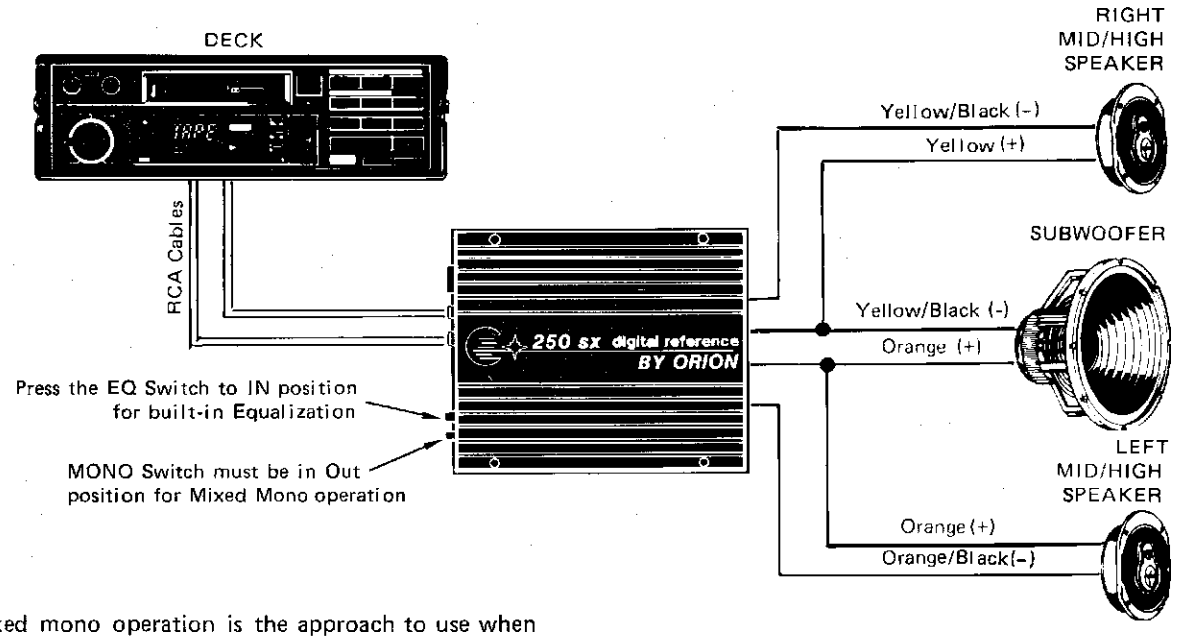



Figure 1. Basic Single-Amplifier System Using Existing Speakers

(1) **Adding a Subwoofer.** For added punch, you could add a subwoofer to the system, perhaps using one of the portable subwoofers available for ease of installation. For this system, you would connect the speakers as shown in figure 2 to take advtange of the mixed mono output of the amplifier. Refer to the discussion covering bridging on page 10.




Mixed mono operation is the approach to use when you want to add a subwoofer to the single amplifier system. This mode can be used to provide more power to the subwoofer while maintaining stereo left and right. The amplifier accepts the stereo inputs and turns one channel over 180 degrees (inverts the channel).

This system also works best with the built-in equalization because it provides +15 dB at 40 Hz to boost the bass and -4 dB attenuation at 200 Hz to take away the mid-bass boom.

Figure 2. Basic Single Amplifier System Using a Subwoofer in the Mixed Mono Mode of Operation

(2) **Front and Rear Speakers.** If your car is equipped with front and rear speakers, you will want to use a separate amplifier for each pair of speakers as shown in figure 3. For better control, use an ORION Equalizer (see page 7).

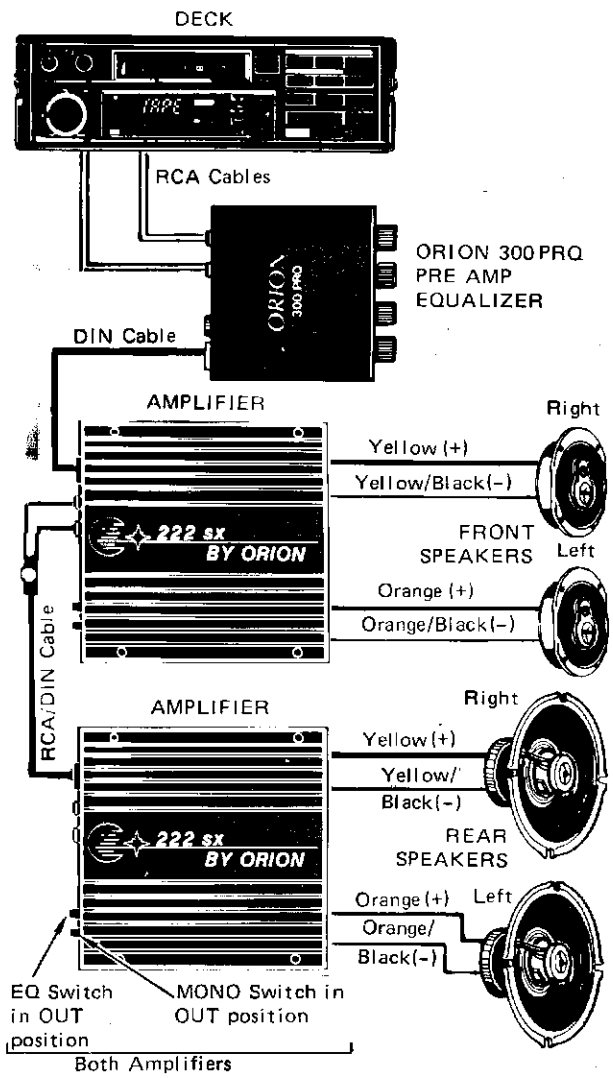



**Figure 3. Basic Two-Amplifier System Using Equalizer and Existing Front and Rear Speakers**

## B. BRIDGING MODE OF OPERATION

The bridging mode of the sx series amplifiers can turn your amplifiers into real power houses. Bridging an amplifier converts the two channels into a single channel (mono output). Each internal channel "sees" half of the total impedance of the load. For example, when using 4-ohm speakers, each channel in the amplifier sees half of this 4 ohms or 2 ohms. If you are using a 250 sx amplifier, which delivers 50 watts per channel, the output delivered to each speaker will be 200 watts when bridged, thus a 4 times increase in output. The sx series amplifiers can be used in the *mixed mono* or *summed mono* mode. The bridged mode requires that the speakers be connected properly and that the MONO switch be pressed to the IN position.

(1) **Mixed Mono Mode.** The mixed mono mode keeps stereo right and stereo left but also provides a mono center channel. It is most often used in a single amplifier system such as shown in figure 2 to provide more power to a subwoofer while maintaining stereo left and right to the mid/high speakers. In this system, the bridging circuit in the amplifier turns one channel over 180 degrees (inverts the channel). Both channel outputs of the amplifier are now connected to the subwoofer with the inverted channel being used as the *negative* input. This works because the two channels are 180 degrees out-of-phase.

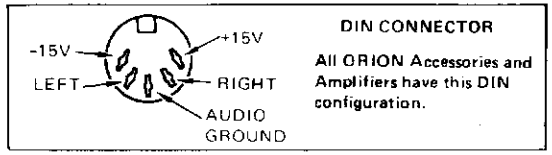
The left mid/high speaker and the right mid/high speaker are connected normally.

(2) **Summed Mono Mode.** The summed mono mode is true mono. This mode is generally used to drive the subwoofers in mono. This application is very practical since in stereo recordings the kick drums and bass are centered between stereo right and stereo left, along with the other rhythm instruments. Always keep in mind that it takes much more power to drive low frequencies than high frequencies. This is why in several of the sample diagrams in this manual 222 sx amplifiers are shown driving the tweeters, 250 sx amplifiers are shown driving the mid-range speakers, and 2125 sx or 2250 sx amplifiers are shown driving the subwoofers in summed mono.

A typical 3-amplifier system using the summed mono mode is shown in figure 4.

**CAUTION:** *The speakers must never be grounded to the car chassis or body. To do so will cause severe noise problems and, in the case of bridging, cancel out the two-phase operation.*

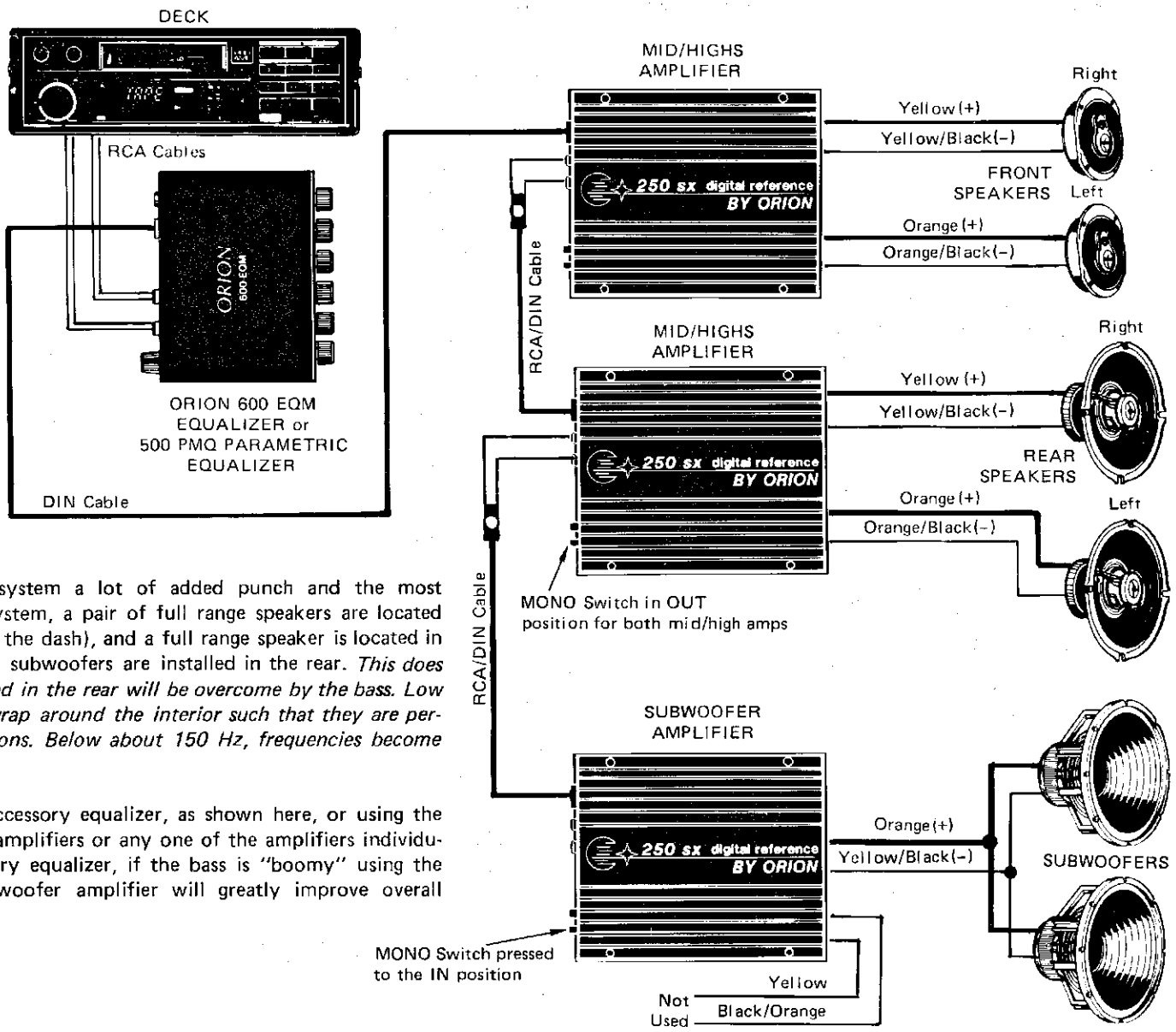
**IMPORTANT NOTE:** *At this point, you must determine if your car has enough power to supply the needs of the engine, lighting system, and air conditioning system as well as the audio system. An existing car electrical system can generally handle up to four 222 sx or up to three 250 sx amplifiers. If you plan to use more, or larger amplifiers, refer to the discussion on power requirements on page 23.*




**'Phantom Power' (+15V & -15V) is supplied to all ORION accessory modules by the amplifier through the DIN cable. (When ORION amplifiers are not used, the ORION PPS 100 Phantom Power Supply is required.)**

NOTE:
The DIN and RCA input connectors for all amplifiers are wired in parallel. This means that when an input is connected to the DIN connector, it is also present at the RCA connectors and the other way around. This makes it possible to connect several amplifiers in parallel as shown in this figure.

"Phantom power is supplied to the equalizer by the amplifier through the DIN cable.




The subwoofers will give your system a lot of added punch and the most coherent natural sound. In this system, a pair of full range speakers are located in the front (usually in the top of the dash), and a full range speaker is located in each rear door or side panel. The subwoofers are installed in the rear. *This does not mean that the passengers seated in the rear will be overcome by the bass. Low frequency sound waves tend to wrap around the interior such that they are perceived as coming from all directions. Below about 150 Hz, frequencies become non-directional.*

You have a choice of using an accessory equalizer, as shown here, or using the built-in equalization for all three amplifiers or any one of the amplifiers individually. Even when using an accessory equalizer, if the bass is "boomy" using the built-in equalization at the subwoofer amplifier will greatly improve overall performance.

Figure 4. Three-Amplifier System Using Existing Front and Rear Speakers with Two Subwoofers Added and Driven in the Summed Mono Mode

## C. USE OF A CROSSOVER MODULE

An ORION 200 CRX Active Crossover or 300 CRX 3-Way Active Crossover can be one of the most important additions to your car audio system. It lets you adjust the highs and midranges to where they sound best, then independently adjust the lows to where they sound great. The 200 CRX Active Crossover contains a low pass filter section (for your subwoofers) and a high pass filter section (for midranges and tweeters). The 300 CRX 3-Way Active Crossover contains a low pass filter section for the subwoofers, a bandpass filter section for the midranges, and a high pass filter section for the tweeters.

(1) **Use of 200 CRX Active Crossover.** This crossover module can be used in a variety of ways. It could be added to the simple two-amplifier system as shown in figure 5. It could also be used in a 3-amp system as shown figure 6. Note in figure 6 that an ORION 200 DAB Dual Amp Balancer has been added to control the level of sound that comes from each section of the car audio system.

(2) **Use of 300 CRX 3-Way Active Crossover.** For even better control, use the 300 CRX as shown in figure 7. This will give you separate control of the low frequencies, midrange frequencies, and high frequencies.

## D. USE OF 30 DBLP LOW PASS FILTER

**NOTE:** *Low pass and high pass filters can only be used effectively in multi-amp systems such as shown in figures 8 through 11.*

If you are using mismatched subwoofers, or having speaker box resonance problems, or experiencing bass distortion , consider using a 30 DBLP Low Pass Filter as shown in figure 8. This filter will keep the midrange and high frequencies out of your subwoofers. The cutoff frequency is selected by plugging in two resistive chips. This means that if you install 80 Hz chips in the filter, only frequencies of 80 Hz and below will pass through to your subwoofers and frequencies above 80 Hz will be blocked.

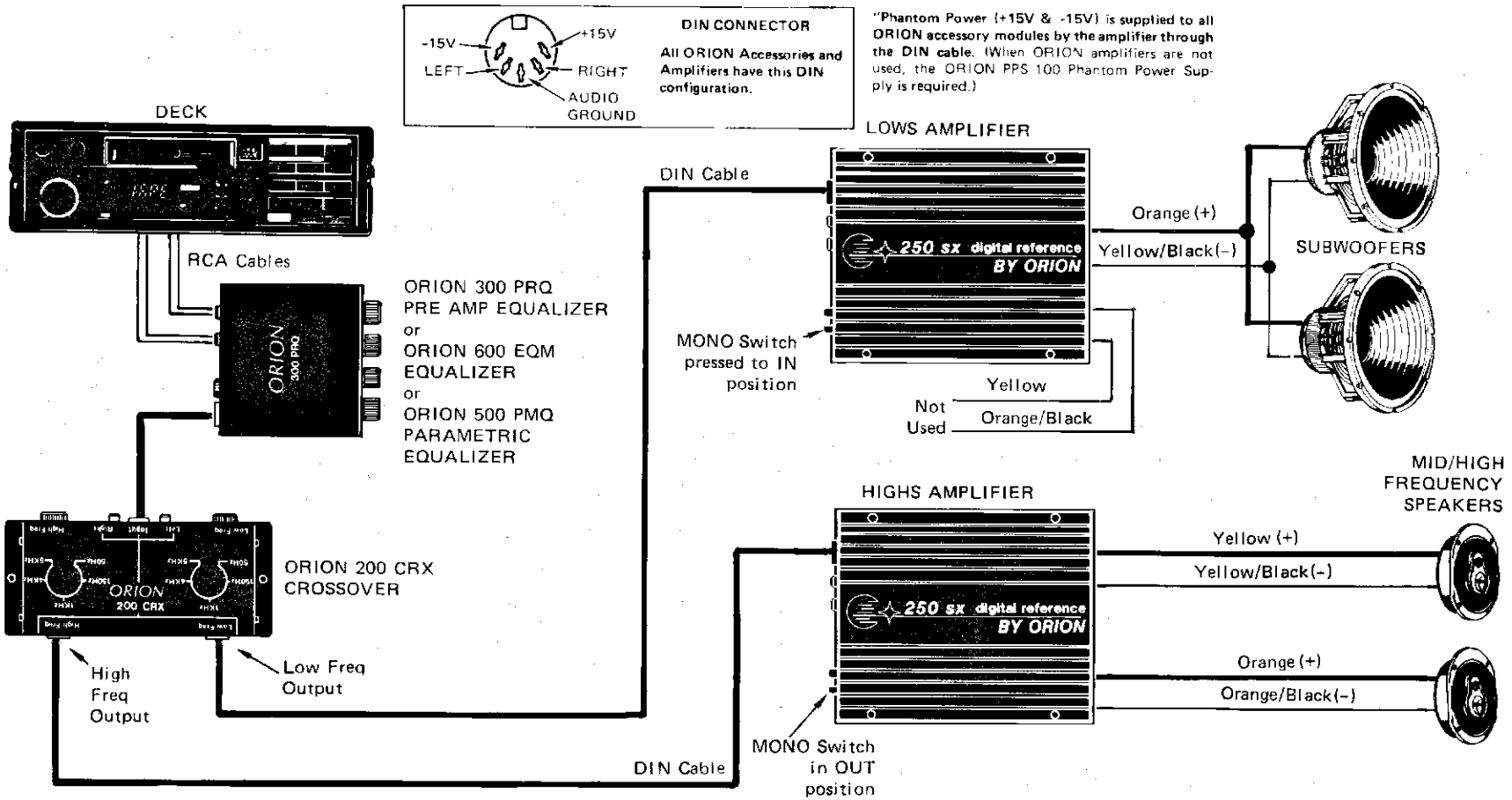
## E. USE OF 30 DBHP HIGH PASS FILTER

The 30 DBHP High Pass Filter is used primarily to make your tweeters sound more lively. Keep in mind that it is the low frequencies that hurt the tweeter performance. A typical application of a high pass filter is shown in figure 9. The high pass filter produces large amounts of attenuation (reduction in power) to frequencies *below* the cutoff frequency and no attenuation to frequencies *above* the cutoff frequency. This means that if you install 4 kHz chips in the filter, only frequencies of 4 kHz and above will pass through to your tweeters and frequencies below 4 kHz will be blocked.

## F. "KILLER SYSTEMS"

Figure 10 shows a "Killer System" that uses an ORION 200 CRX Active Crossover to separate the highs from the lows. A 30 DBHP High Pass Filter is used to enhance the performance of separate pair of tweeters. All subwoofers are driven from the SUMMED MONO output of a 400 BDG Bridging Module. A 30 DBLP Low Pass Filter is used to control the lows to a selected set of subwoofers.

Figure 11 shows a "Killer System" that uses an ORION 300 CRX Active Crossover to separate the highs, midranges and lows. This approach offers the best overall control of the speakers and makes it possible to use several amplifiers connected in parallel.




This is a simple two-amplifier system using a 200 CRX Active Crossover for better control of the frequencies applied to the speakers. The LOW FREQ output is connected to the lows amplifier to drive the subwoofers, and the HIGH FREQ output is connected to the highs amplifier for driving the midrange and highs speakers.

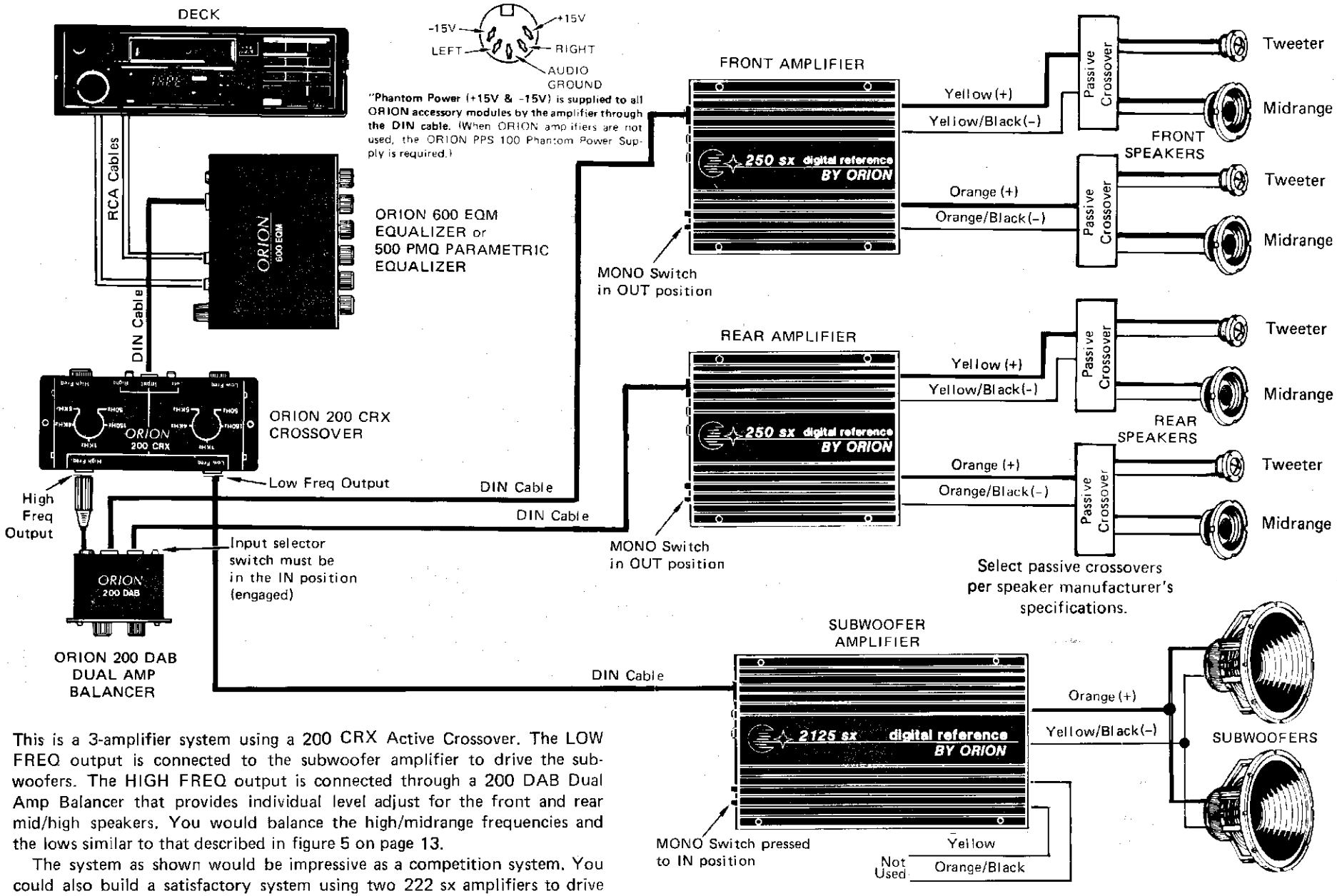
This allows you to carefully balance the higher and midrange frequencies with the lows. In practice, overlapping the crossover point slightly results in smooth transitions of sounds delivered to the speakers. For example, the cutoff frequency for lows could be adjusted to 400 Hz. This would mean that all frequencies below 400 Hz would be passed to the lows amplifier at 100% power. The attenuation (reduction in power) is 12 dB which is a reduction in power of about 90%. An octave is a doubling of frequency so that at 800 Hz only about 10% of the power would go to the subwoofers. In this example, the high output would be adjusted to pass only frequencies above 300 Hz. This would give you about 100 Hz overlap. Then you could make slight adjustments to provide the sound that pleases you the most.

In a system utilizing a lows amplifier to drive the subwoofers, you would probably always want to use the summed mono mode as shown here. Use of the built-in equalization or an ORION accessory equalizer depends on personal taste. If the bass is "boomy", whether or not you use an accessory equalizer, the built-in equalization at the lows amplifier will improve overall performance.

This system could be designed using two 222 sx amplifiers (22 watts per channel) or two 250 sx amplifiers (50 watts per channel). For added power, you could choose a 2125 sx for the mid/high speakers and a 2250 sx for the lows amplifier.

For installation, connections and adjustments, refer to pages 22 through 30.

**Figure 5. Two-Amplifier System Using an ORION 200 CRX Active Crossover**

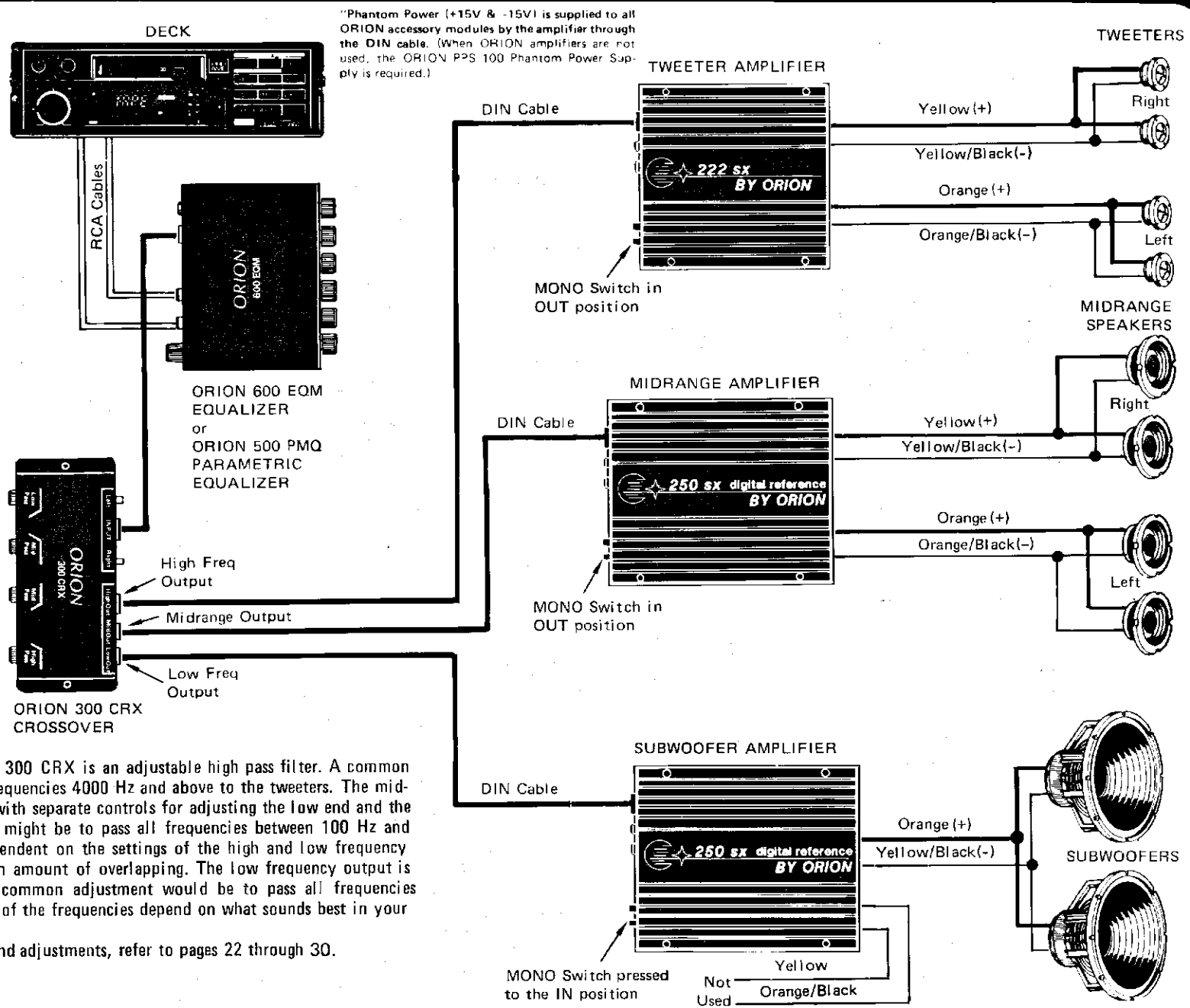



This is a 3-amplifier system using a 200 CRX Active Crossover. The LOW FREQ output is connected to the subwoofer amplifier to drive the subwoofers. The HIGH FREQ output is connected through a 200 DAB Dual Amp Balancer that provides individual level adjust for the front and rear mid/high speakers. You would balance the high/midrange frequencies and the lows similar to that described in figure 5 on page 13.

The system as shown would be impressive as a competition system. You could also build a satisfactory system using two 222 sx amplifiers to drive the midrange speakers and tweeters and a 250 sx amplifier to drive the subwoofers. In either case, you would use the subwoofer amplifier in the summed mono mode.

For installation, connections and adjustments, refer to pages 22 through 30.

Figure 6. Three-Amplifier System Using 200 CRX Active Crossover and 200 DAB Dual Amp Balancer




This is 3-amp system using a 300 CRX 3-Way Active Crossover. The 300 CRX makes it possible to use separate amplifiers for the tweeters, midrange speakers, and subwoofers.

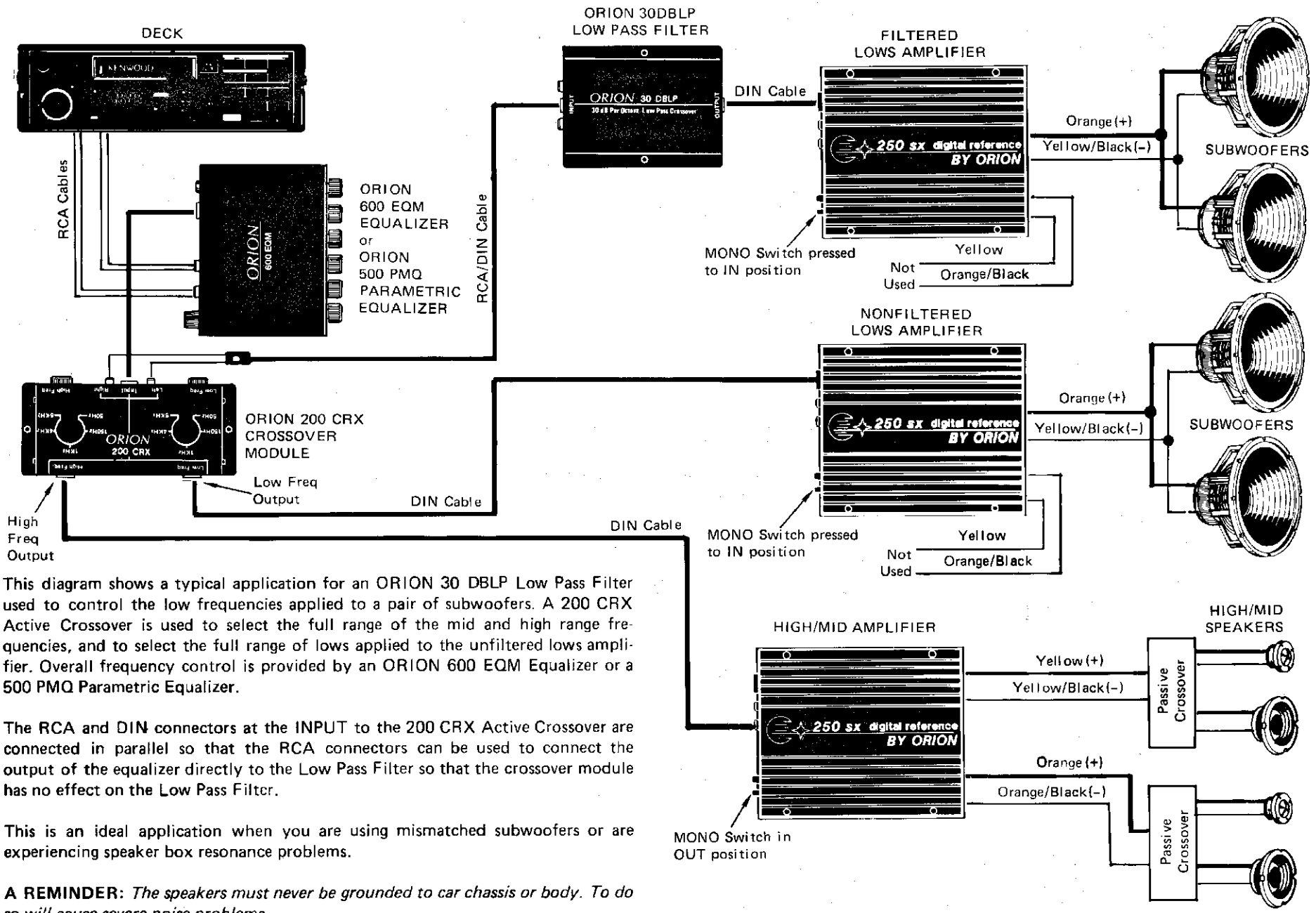
Less power is required to drive the high frequencies to the tweeters than that required for the midrange and low frequencies, so this diagram shows a 222 sx (22 watts per channel) being used for the tweeters.

The midrange and subwoofer amplifiers could be selected according to your output power requirements and space availability. (If you decide to use three 222 sx's or two 250 sx amps with a 2125 sx, you may have to add an additional battery. Refer to page 23.)

The high frequency output of the 300 CRX is an adjustable high pass filter. A common adjustment would be to pass all frequencies 4000 Hz and above to the tweeters. The midrange output is a bandpass filter with separate controls for adjusting the low end and the high end. A common adjustment might be to pass all frequencies between 100 Hz and 4100 Hz, but the settings are dependent on the settings of the high and low frequency outputs. There should be a certain amount of overlapping. The low frequency output is an adjustable low pass filter. A common adjustment would be to pass all frequencies below 180 Hz. The actual settings of the frequencies depend on what sounds best in your system.

For installation, connections and adjustments, refer to pages 22 through 30.

Figure 7. Three-Amplifier System Using a 300 CRX 3-Way Active Crossover



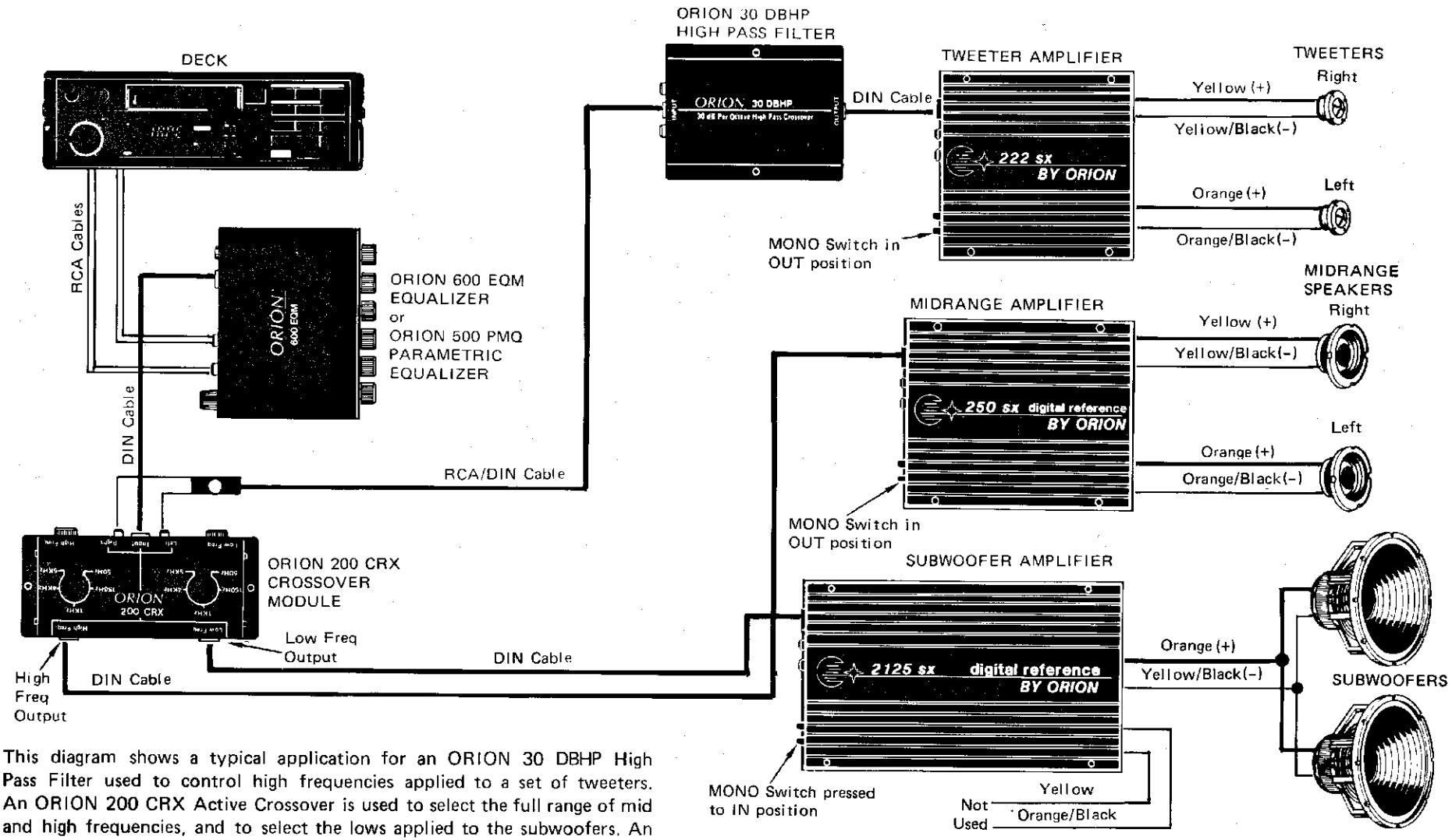

This diagram shows a typical application for an ORION 30 DBLP Low Pass Filter used to control the low frequencies applied to a pair of subwoofers. A 200 CRX Active Crossover is used to select the full range of the mid and high range frequencies, and to select the full range of lows applied to the unfiltered lows amplifier. Overall frequency control is provided by an ORION 600 EQM Equalizer or a 500 PMQ Parametric Equalizer.

The RCA and DIN connectors at the INPUT to the 200 CRX Active Crossover are connected in parallel so that the RCA connectors can be used to connect the output of the equalizer directly to the Low Pass Filter so that the crossover module has no effect on the Low Pass Filter.

This is an ideal application when you are using mismatched subwoofers or are experiencing speaker box resonance problems.

**A REMINDER:** *The speakers must never be grounded to car chassis or body. To do so will cause severe noise problems.*

Figure 8. Typical Use of an ORION 30 DBLP Low Pass Filter to Set Upper Limits of Low Frequencies

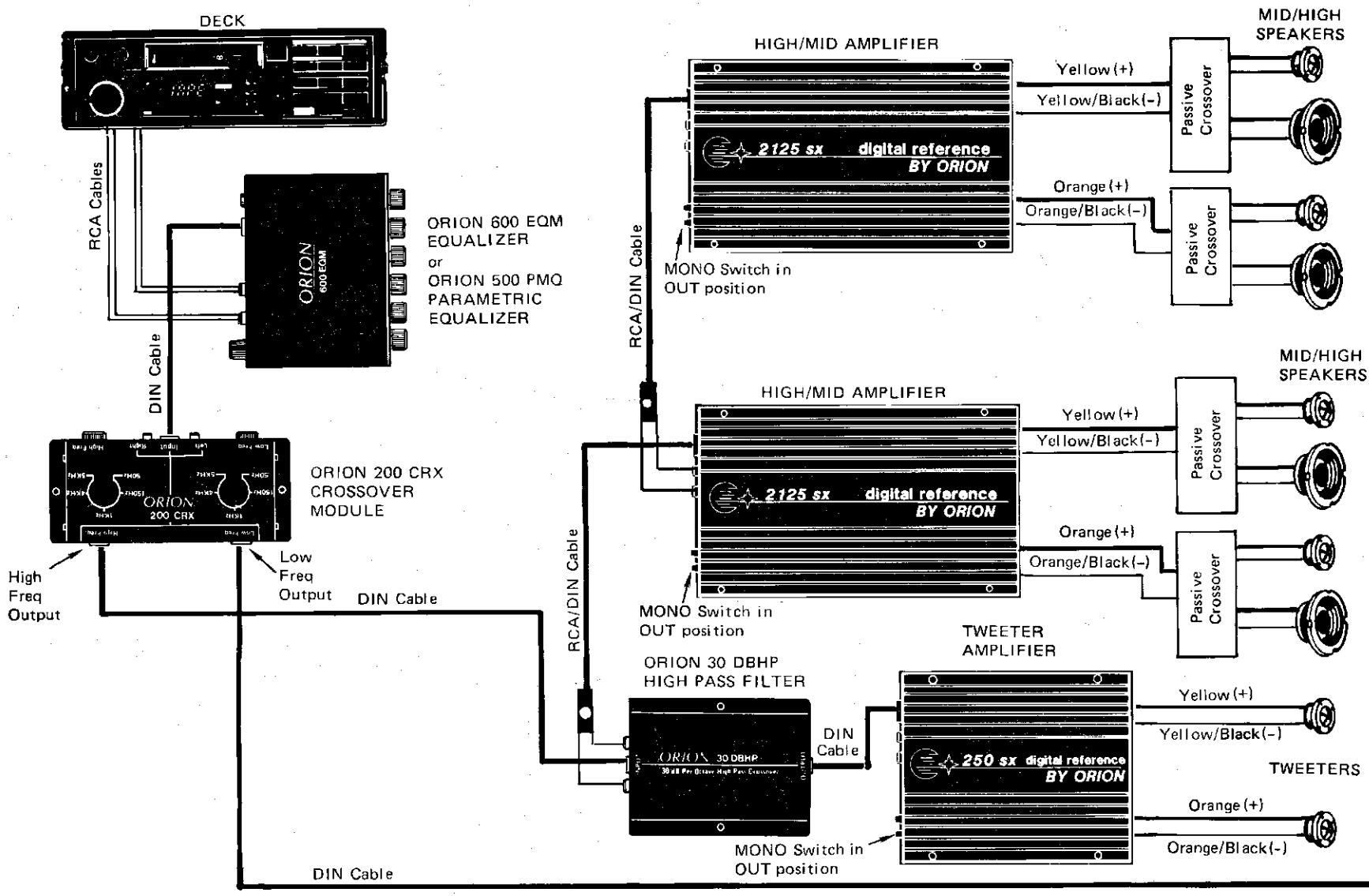


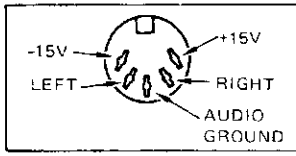

This diagram shows a typical application for an ORION 30 DBHP High Pass Filter used to control high frequencies applied to a set of tweeters. An ORION 200 CRX Active Crossover is used to select the full range of mid and high frequencies, and to select the lows applied to the subwoofers. An ORION 600 EQM Equalizer or 500 PMQ Parametric Equalizer is used to provide overall frequency control.

The RCA and DIN connectors at the INPUT to the 200 CRX Active Crossover are connected in parallel so that the RCA connectors can be used to connect the input stereo signals to the 30 DBHP High Pass Filter. Since the high pass filter input is received directly from the equalizer, the crossover module has no affect on the high pass filter.

"Phantom Power (+15V & -15V) is supplied to all ORION accessory modules by the amplifier through the DIN cable. (When ORION amplifiers are not used, the ORION PPS 100 Phantom Power Supply is required.)

Figure 9. Typical Use of an ORION 30 DBHP High Pass Filter to Set Lower Limits of High Frequencies



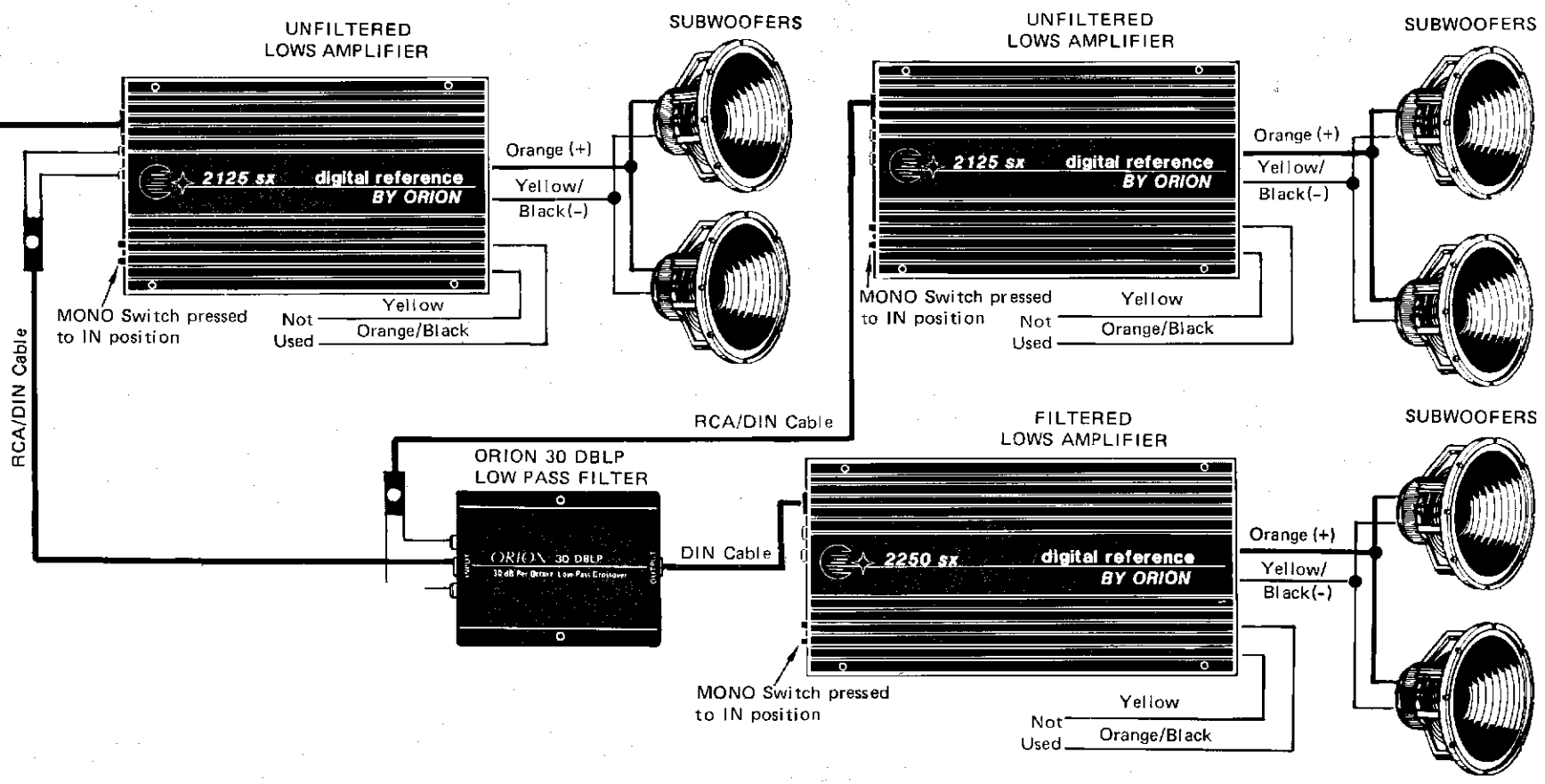




**DIN CONNECTOR**

All ORION Accessories and Amplifiers have this DIN configuration.

**'Phantom Power' (+15V & -15V) is supplied to all ORION accessory modules by the amplifier through the DIN cable. (When ORION amplifiers are not used, the ORION PPS 100 Phantom Power Supply is required.)**

Figure 10. "Killer System" Using ORION Low Pass and High Pass Filters to Fine Tune the System




This diagram shows a full competition "Killer System" that has been fine tuned using ORION Low Pass and High Pass Filters. An ORION 200 CRX Active Crossover is used to separate the high/mids from the lows. The lows are then supplied to two lows amplifiers that amplify the full spectrum of lows selected at the 200 CRX (say 260 Hz and below). Each lows amplifier then drives two subwoofers. Up to 20 amplifiers could be connected in parallel as shown here.

The lows output of the 200 CRX Active Crossover is also applied to an ORION 30 DBLP Low Pass Filter that selects a cutoff frequency that will emphasize only the lower range (say 72 Hz and below). Keeping in mind that the lower the frequency band, the more power is required to drive the subwoofers, a 2250 sx is shown driving the filtered frequencies.

All lows amplifiers are shown being operated in the summed mono mode to provide maximum power to the subwoofers.

The high frequency output of the 200 CRX Active Crossover is applied to two high/midrange amplifiers that reproduce the full spectrum of selected high and mid frequencies (say 200 to 4200 Hz).

The high frequency output is also applied to an ORION 30 DBHP High Pass Filter that selects a cutoff frequency that will emphasize only the highest frequencies (say 4000 Hz and above).

An ORION 600 EQM Equalizer or 500 PMQ Parametric Equalizer is used to balance the overall system.

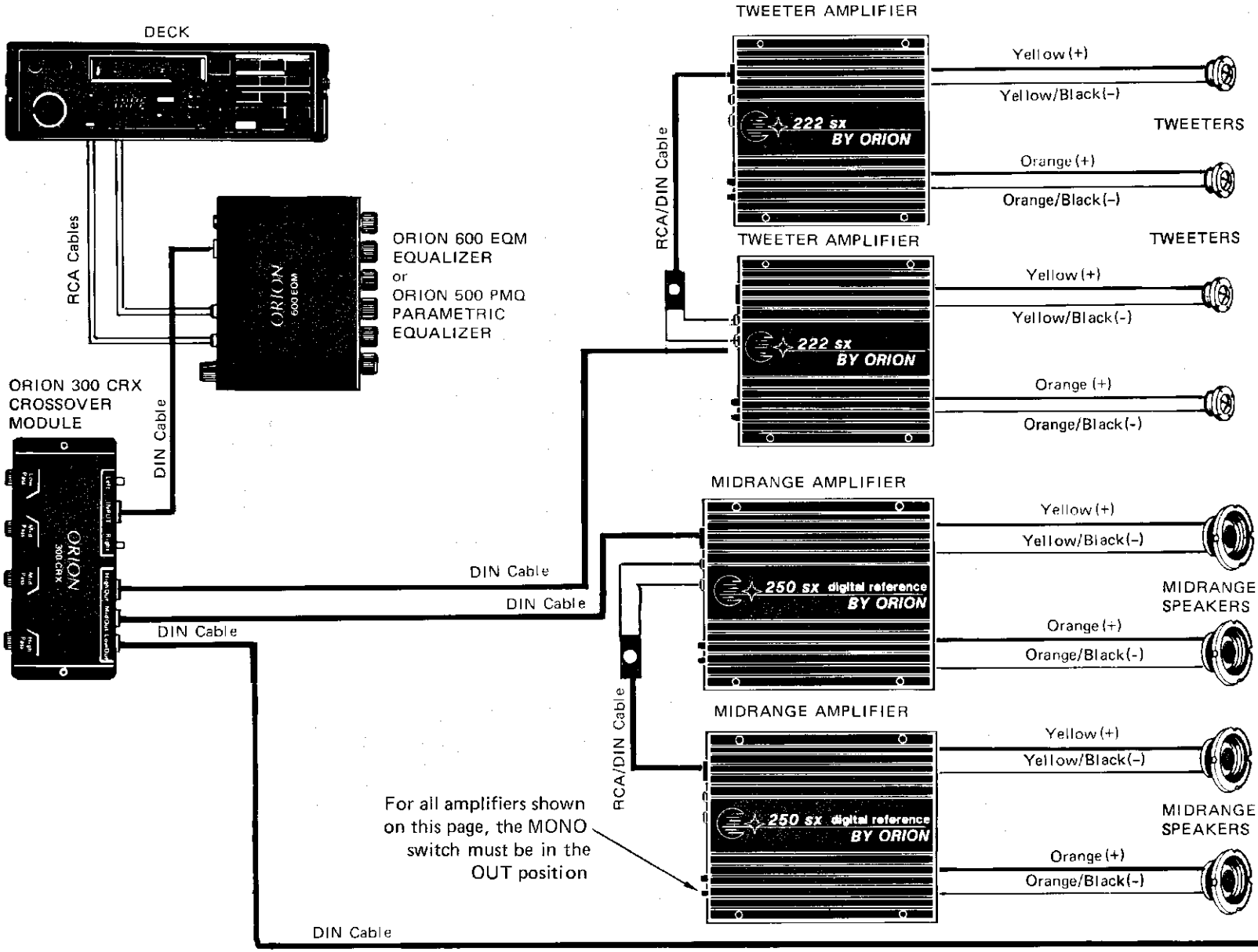
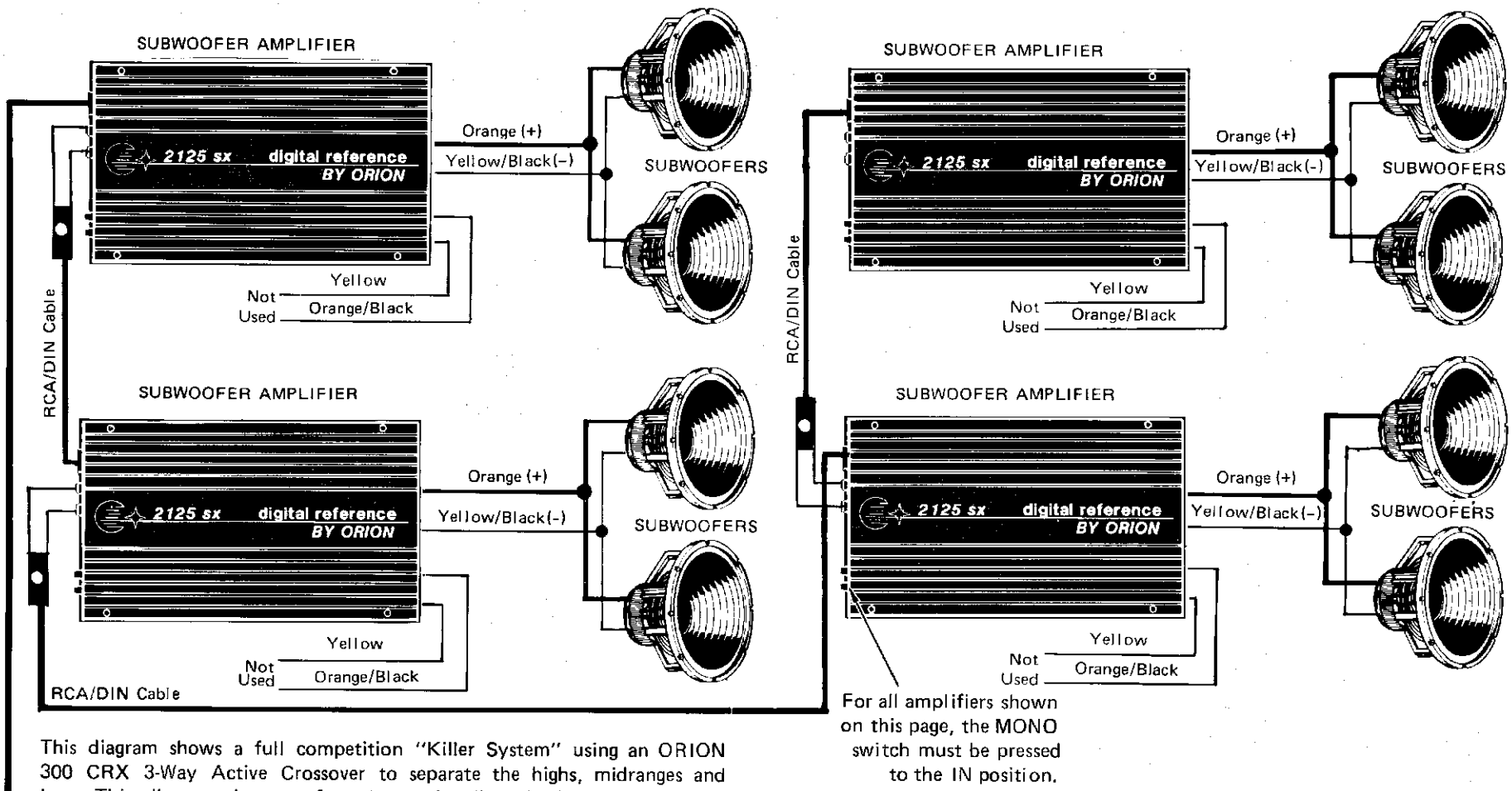



Figure 11. "Killer System" Utilizing a 300 CRX 3-Way Active Crossover and Individual Amplifiers for Each Speaker Type
(Up to 20 Subwoofer Amplifiers Can be Used)

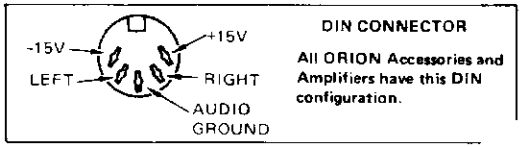



For all amplifiers shown on this page, the MONO switch must be pressed to the IN position.

This diagram shows a full competition "Killer System" using an ORION 300 CRX 3-Way Active Crossover to separate the highs, midranges and lows. This allows each type of speaker to handle only those frequencies it was designed to reproduce. The subwoofer amplifiers are all operated in the summed mono mode. Up to 20 amplifiers can be connected in parallel as shown in this diagram. For added power, 2250 sx amplifiers could be used in place of the 2125 sx amplifiers shown.

The selected high frequencies are kept in stereo and applied to a pair of tweeter amplifiers. Since the high frequencies require much less power, the diagrams shows smaller amplifiers being used to drive the tweeters than those used for the mid and low frequencies.

The selected midrange frequencies are also kept in stereo and applied to a pair of amplifiers that drive the midrange speakers.




"Phantom Power (+15V & -15V) is supplied to all ORION accessory modules by the amplifier through the DIN cable. (When ORION amplifiers are not used, the ORION PPS 100 Phantom Power Supply is required.)

# MOUNTING THE AMPLIFIER

When planning where to install your amplifier, you must first think in terms of keeping the amplifier cool enough to function properly. Amplifiers are heat-sensitive. This means that the operating parameters may change with fluctuations in temperature and an amplifier can literally be destroyed by excessive heat during operation.

The finned outer surface of the amplifier is a *heat sink* which helps to carry heat away by means of thermal conduction. Therefore, you must allow the amplifier to breathe so that the heat sink can best do its job.

It is always best to mount the amplifier flat on the floor under the front seat or in the front of the car trunk. Remember heat travels up.

- Avoid heat traps.
- Don't put a glass or metal cover over the top of the amplifier unless you have a cooling fan at one end.
- Keep in mind that any moving air dissipates heat.
- If possible, duct the car air conditioning system so that cooling air is directed along the fins of the amplifier heat sink.
- Cooling air should be directed along the fins rather than across them for the most efficient cooling.
- Don't mount the amplifier on plastic or use a plastic cover. The plastic will melt.

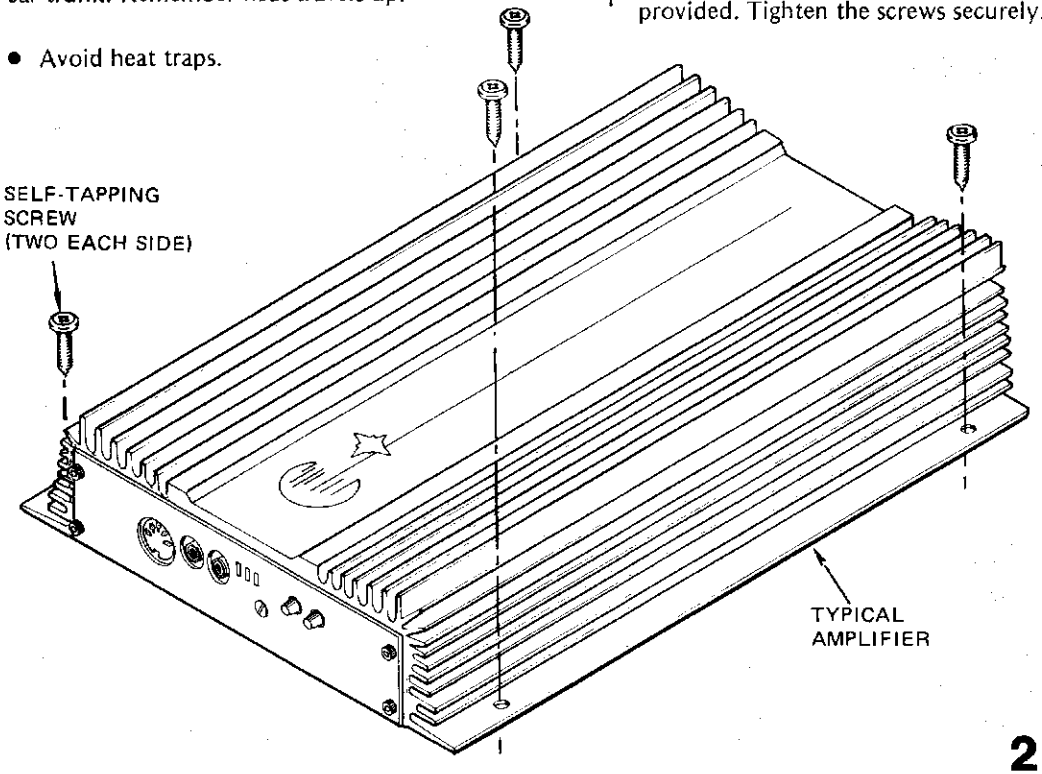
Once you have selected the mounting location, mount the amplifier using the four self-tapping screws provided. Tighten the screws securely.

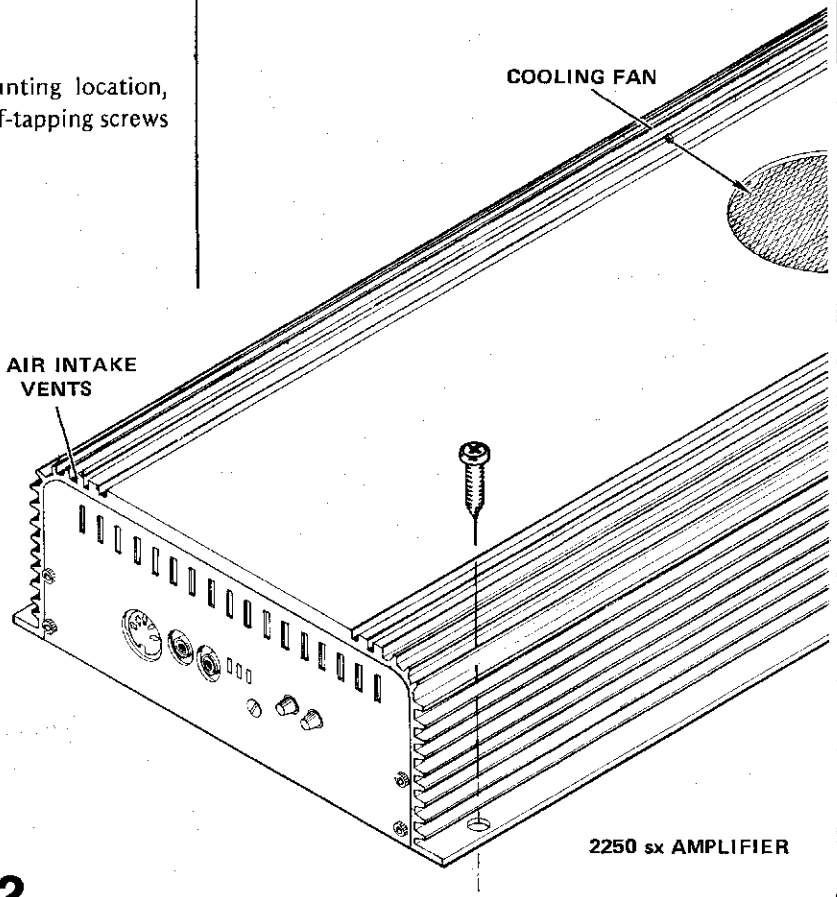
**IMPORTANT:** The **2250 sx** contains a cooling fan and air intake vents at each end. Do NOT block the intake vents or the fan outlet or the amplifier will not receive adequate ventilation.

Also before mounting the 2250 sx, refer to the "Power Connections" diagram on pages 28 and 29 to determine positioning with respect to the additional battery and circuit breaker.

## CAUTION

**Be very careful not to drill into the fuel tank, fuel lines, or through electrical wiring.**



# POWER AND GROUND CONNECTIONS

## IMPORTANT CAUTIONS

1. **Improper wiring connections can seriously damage amplifiers, accessories, or speakers. Follow the connecting instructions in this manual carefully. When in doubt, contact your dealer.**

2. **Disconnect the battery positive (+) lead before making any power connections.**

3. **Always connect the power cable assembly directly to the positive (+) terminal on the battery. Do NOT connect to the car fuse panel. Do NOT use a smaller gage wire for the hot lead than that coming out of your amplifier.**

4. **Make sure that the power ON-OFF switch that controls the amplifiers is turned OFF when making any connections.**

5. **Make sure that all connections are clean and properly secured. Failure to do so may result in damage to your equipment.**

6. **Always replace fuses with the same FAST BLOW current rating as those supplied with your amplifier. Incorrect fuses can result in serious damage to the components in the system.**

7. **The speakers must never be grounded to the car chassis or body. To do so will cause severe noise problems and, in case of bridging, cancel out the two-phase operation.**

8. **Make sure that your car has enough power to handle all car systems as well as your audio system. Read about power requirements below carefully.**

## A. Low Power Systems

Before installing your audio system, you must make sure that your car has enough power to service all of the car electrical components (engine, headlights, windshield wipers, air conditioning, etc.) and still handle the power required to supply your audio system at full power.

Use a little common sense. If you are installing a system containing two or three 222 sx or two 250 sx amplifiers, your existing factory electrical system will probably handle your power requirements.

An existing system will probably handle a 2125 amplifier just fine, but if you install two of these amplifiers, you probably won't be able to run the system at full power at night with the headlights on. If you want to install two of these amplifiers and run at full power at night, you will probably have to install a heavy duty alternator and a premium battery (or even a second battery) as described in B below.

**If you attempt to overload your existing system, you will burn out the brushes or field diodes in your alternator and greatly reduce the life of your battery.**

## B. Multiple Amplifier Systems

Multiple-amplifier systems (except as described in A above) require additional battery and/or charging power.

Competition systems, such as those shown in figures 9, 10 and 11, should contain multiple batteries or be powered by an external battery charger or dc power supply with a current rating in excess of that required by all combinations of the components in your system.

For standard multi-amplifier systems, you must install a heavy duty alternator and at least one extra battery. Preferrably, all batteries should be deep cycle marine batteries.

When batteries are connected in parallel, the voltage across each battery is the same and the batteries share the load current. The alternator will generally maintain the charge on both batteries equally. A common problem, however, is that a new battery may drain an older battery. For example, if a new premium battery is installed and the older battery has had several months of use, the life of the older battery will usually be shortened. The ideal situation is to install two new premium batteries so that all potentials remain the same.

Do not use isolators at the alternator.

The power lead for each amplifier should be connected directly to the positive terminal of the battery as shown on pages 25 and 26. In large multi-amplifier systems, the power leads can be connected to a heavy buss bar, but the lead to the battery positive terminal must be at least No. 4 wire gage for 100 ampere service.

Keep in mind that an amplifier can only supply its full power if it has enough battery power being supplied to it.

**All ORION amplifiers are designed to mute 40 dB if battery power drops below 10 volts.**

## C. Grounding Amplifiers

For any audio system, you should first go to the battery and get rid of that little 12 or 14 gage wire that goes from the ground terminal to the chassis and install a braided ground strap at least 1-inch wide from the battery negative terminal to the chassis. Leave the original ~~ground~~ strap connected to the engine.

The ground wire for each amplifier must be connected directly to the car chassis not more than 18 inches from the amplifier. Longer ground leads will usually cause ground loops.

Do NOT ground the amplifiers at the same point. Use a separate grounding point for each amplifier.

The ground point should be a metal chassis member that is welded to the main body of the car. Scrape any paint from the grounding point and clean with sandpaper just before attaching the ground lug. After the ground lug has been securely tightened, cover the bare metal area with paint or grease to prevent rust.

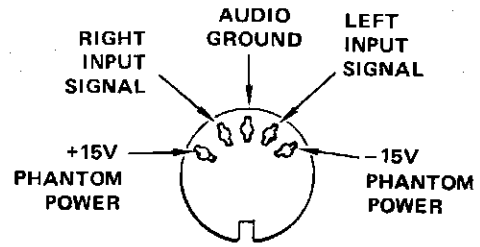
The ground lead is every bit as important as the power lead. Many audio systems troubles are the result of improper ground connections.

Ground is a term generally used to describe the common connection in an electrical or electronic circuit. The common connection is usually the same potential for all circuits in the system. It is the source of electron flow. Remember that the basic principle is that electrons flow from negative to positive.

In cars, the ground is almost always the metal chassis or body and originates at the negative (-) terminal of the battery.

A ground connection should have the least possible resistance which is why we emphasize that the ground wire for an amplifier should be as short as possible (18-inches long maximum). Longer wires add resistance and make the circuit susceptible to ground loops which can result in hum pickup and other electromagnetic interference.

Electromagnetic interference is a combination of electric and magnetic fields caused by alternating current (or frequencies) radiating from the wires and being picked up on the signal leads to and from your amplifier. This type interference may show up as popping, bursts of static, or random noise.

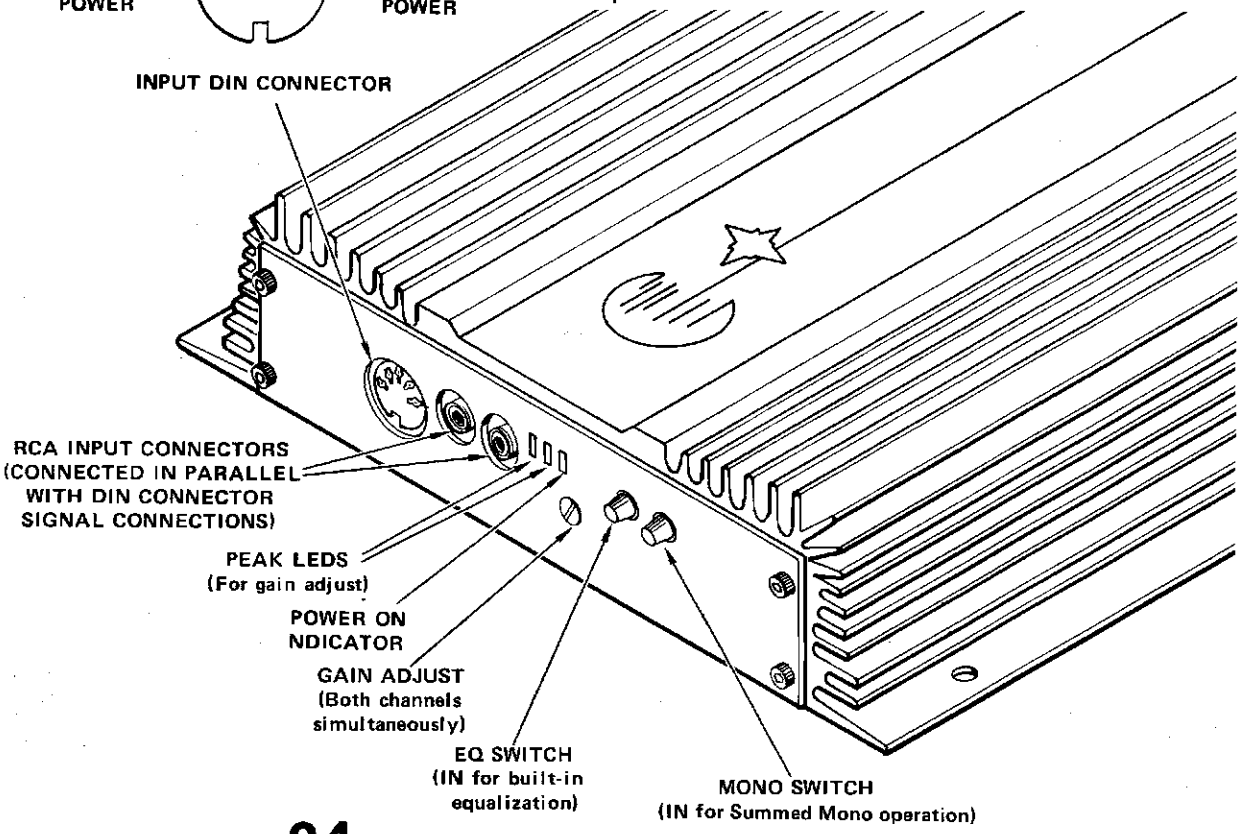



## Phantom Power

Phantom Power (+15V and -15V) is present at all DIN connectors at the INPUT to all ORION amplifiers. This voltage is for use in providing operating power to any ORION accessory that contains active electronic circuits. This includes all crossover modules, equalizers, and low pass and high pass filters.

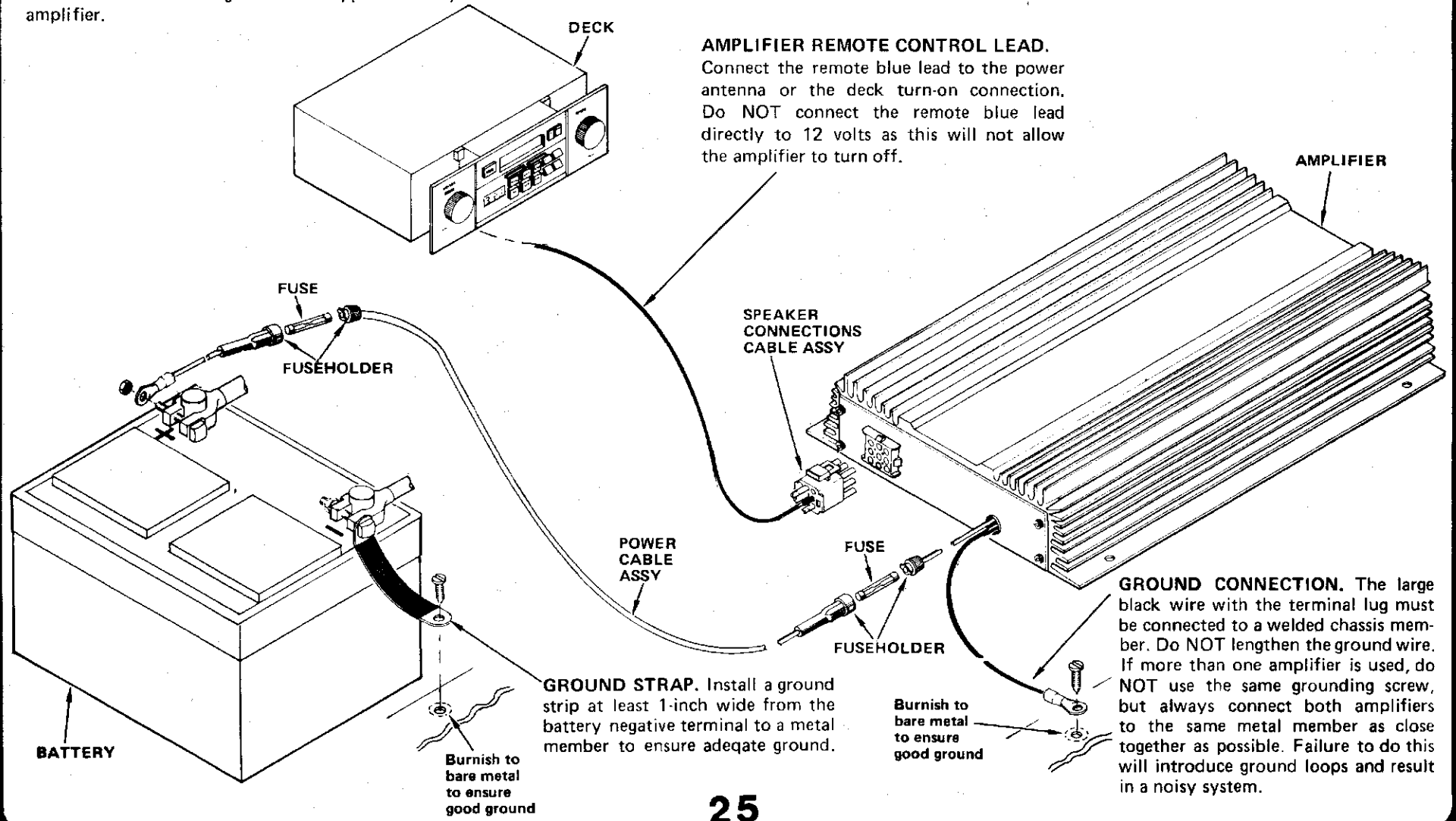
**NOTE**: *Active electronic circuits require a source of dc power for operation, offer no resistance to the signals, and often add gain. Passive electronic circuits, such as used for speaker crossovers, do not require dc power and add resistance to signals.*

The ORION accessories use insignificant amounts of power and need not be figured into the overall power requirements for you audio system.


INPUT DIN CONNECTOR
RCA INPUT CONNECTORS (CONNECTED IN PARALLEL WITH DIN CONNECTOR SIGNAL CONNECTIONS)
PEAK LEDS (For gain adjust)
POWER ON NDICATOR
GAIN ADJUST (Both channels simultaneously)
EQ SWITCH (IN for built-in equalization)
MONO SWITCH (IN for Summed Mono operation)

# Power Connections for 222 sx or 250 sx Amplifiers

**BATTERY CONNECTIONS.** Always connect the power cable assembly directly to the positive terminal on the battery. *Do NOT connect to the car fuse panel.* The 222 sx and 250 sx amplifiers are provided with two fuses. The fuse at the battery is designed to prevent fire or damage to your car should there be a ground short. The second fuse protects the amplifier itself. *Do NOT substitute fuses.* Always replace with fuses of the same fast blow current rating as those supplied with your amplifier.



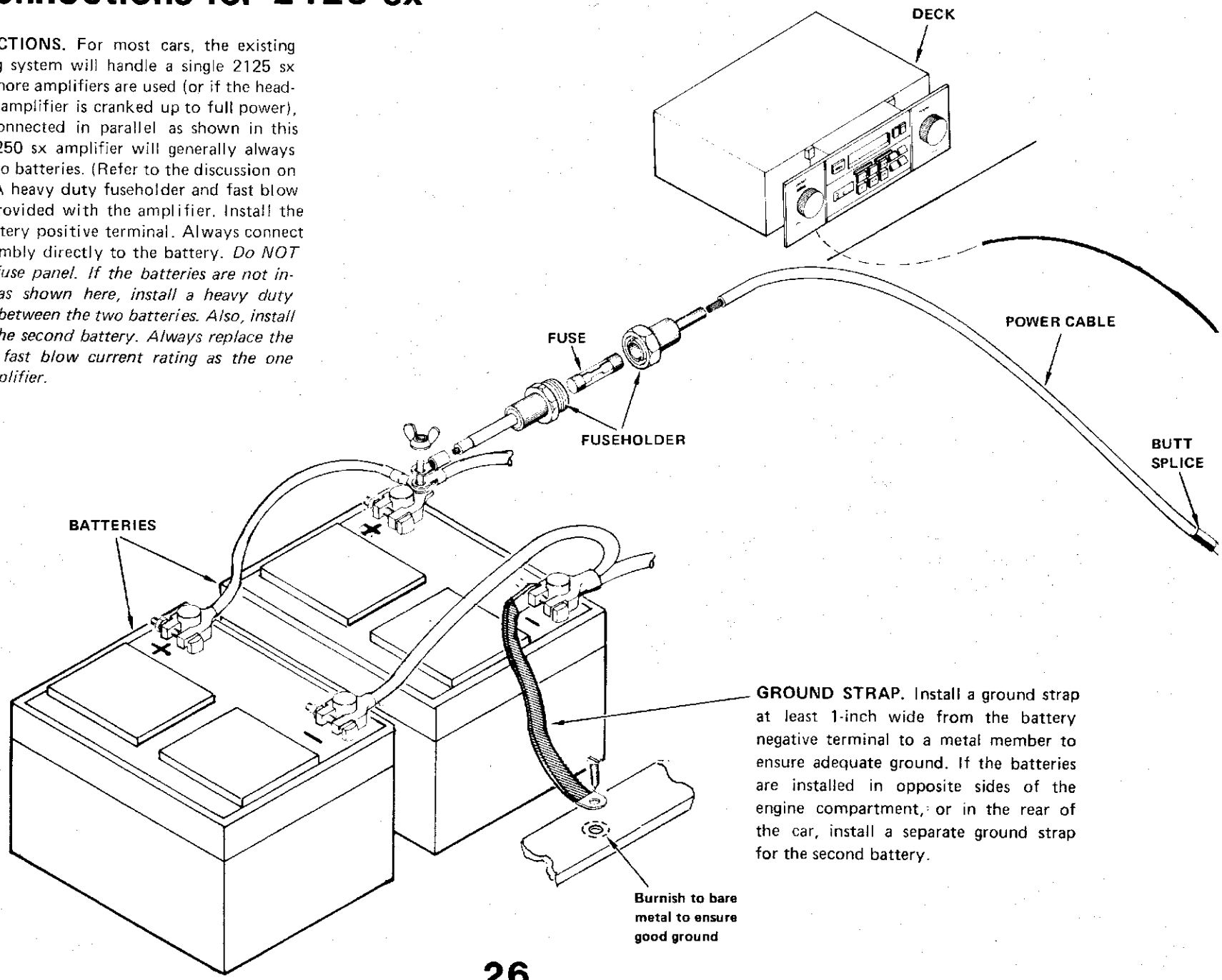

**AMPLIFIER REMOTE CONTROL LEAD.** Connect the remote blue lead to the power antenna or the deck turn-on connection. Do NOT connect the remote blue lead directly to 12 volts as this will not allow the amplifier to turn off.

**GROUND STRAP.** Install a ground strip at least 1-inch wide from the battery negative terminal to a metal member to ensure adeqate ground.

**GROUND CONNECTION.** The large black wire with the terminal lug must be connected to a welded chassis member. Do NOT lengthen the ground wire. If more than one amplifier is used, do NOT use the same grounding screw, but always connect both amplifiers to the same metal member as close together as possible. Failure to do this will introduce ground loops and result in a noisy system.

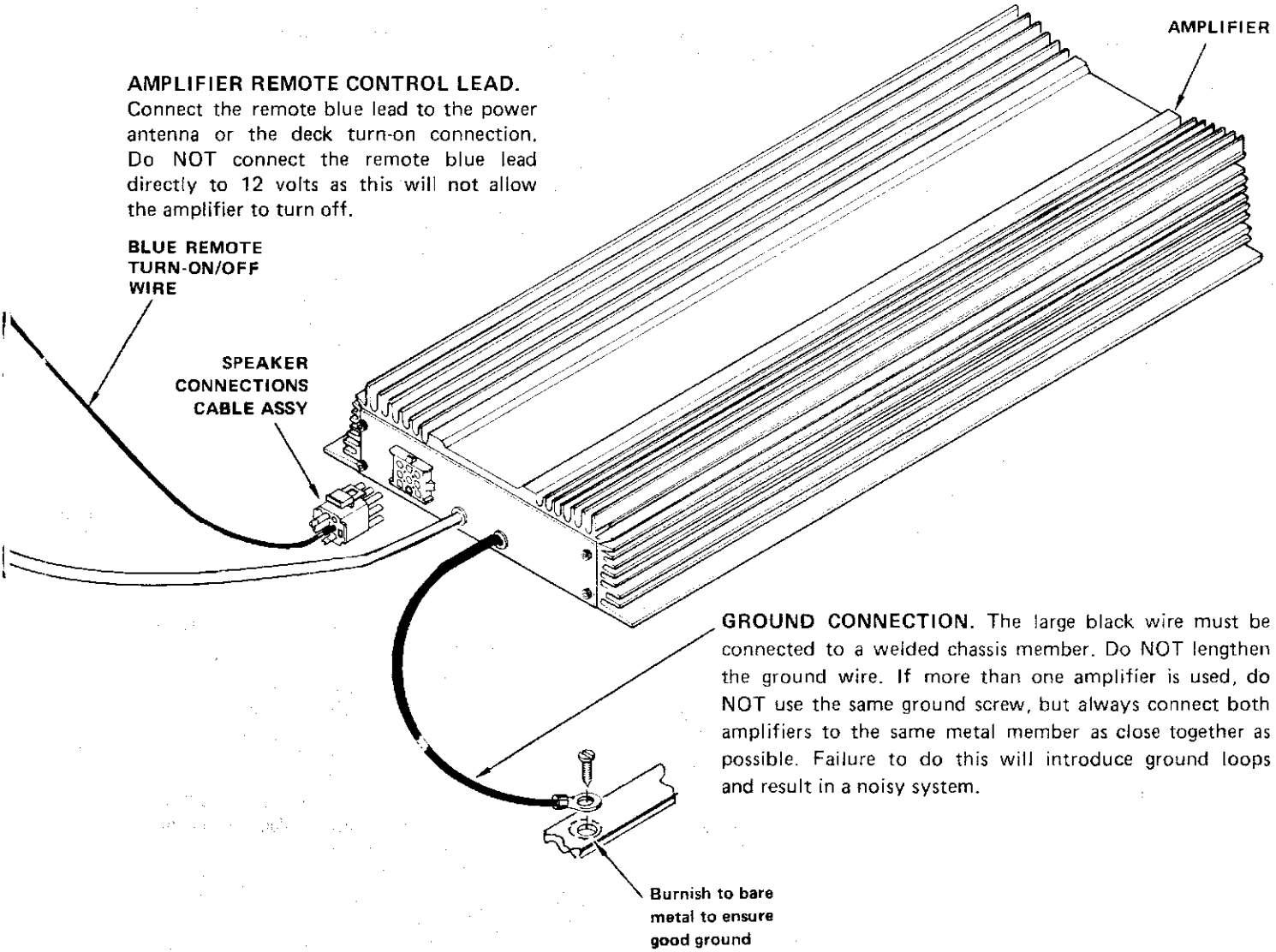
# Power Connections for 2125 sx

**BATTERY CONNECTIONS.** For most cars, the existing battery and charging system will handle a single 2125 sx amplifier. If two or more amplifiers are used (or if the headlights dim when the amplifier is cranked up to full power), use two batteries connected in parallel as shown in this diagram. A single 2250 sx amplifier will generally always require the use of two batteries. (Refer to the discussion on pages 23 and 24). A heavy duty fuseholder and fast blow 40 ampere fuse is provided with the amplifier. Install the fuseholder at the battery positive terminal. Always connect the power cable assembly directly to the battery. *Do NOT connect to the car fuse panel. If the batteries are not installed side-by-side as shown here, install a heavy duty fuse in the hot lead between the two batteries. Also, install a ground strap for the second battery. Always replace the fuse with the same fast blow current rating as the one supplied with the amplifier.*




**GROUND STRAP.** Install a ground strap at least 1-inch wide from the battery negative terminal to a metal member to ensure adequate ground. If the batteries are installed in opposite sides of the engine compartment, or in the rear of the car, install a separate ground strap for the second battery.

**AMPLIFIER REMOTE CONTROL LEAD.** Connect the remote blue lead to the power antenna or the deck turn-on connection. Do NOT connect the remote blue lead directly to 12 volts as this will not allow the amplifier to turn off.

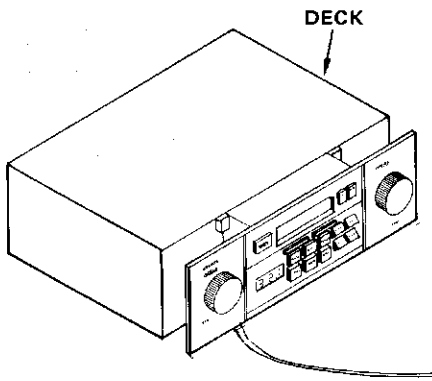



**GROUND CONNECTION.** The large black wire must be connected to a welded chassis member. Do NOT lengthen the ground wire. If more than one amplifier is used, do NOT use the same ground screw, but always connect both amplifiers to the same metal member as close together as possible. Failure to do this will introduce ground loops and result in a noisy system.

# Power Connections for 2250 sx

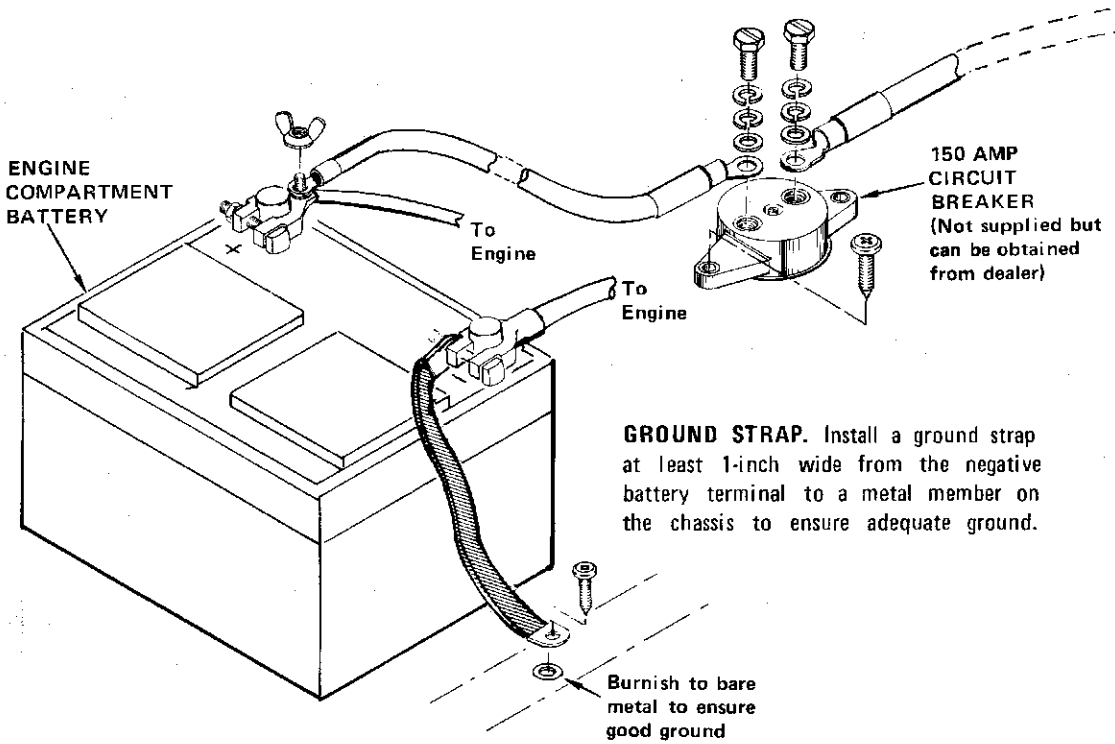
**BATTERY CONNECTIONS** — Install a separate heavy duty premium battery to service the amplifier. Refer to the discussion on "Batteries in Parallel" on page 23. Make battery connections as follows:

1. Refer to Detail "A" on this diagram and turn the amplifier upside down.
2. Remove the plastic caps from the setscrew access holes. You may have to rotate the plastic cap so that the notch in the cap permits removal.
3. Using the Allen wrench supplied with the mounting hardware package to loosen both setscrews enough to permit insertion of the stripped and tinned ends of the black ground cable and red power cable. Insert the black ground cable into the BATTERY - hole and the red power cable into the BATTERY + as far as they will go. Tighten the setscrews just enough to hold the cables firmly. **CAUTION:** *Do NOT overtighten the screws. Overtightening may strip the threads on the screws.*
4. Replace the plastic caps and turn the amplifier upright.
5. Mount the amplifier and connect the black ground cable to a metal member of the car frame.
6. Install the circuit breaker (supplied) so that the red power cable can be attached with a slight loop in the cable to prevent straining the connections. Connect the red power cable to the circuit breaker and tighten the attaching screw securely.
7. Connect the small lug on the red battery cable to the circuit breaker and the large lug end to the positive battery terminal.
8. Connect the positive terminal of the rear battery to the engine compartment battery positive terminal. Install a 150 ampere fuse or circuit breaker in this line as shown in this diagram.
9. At both batteries, install a ground strap at least 1-inch wide or a heavy duty grounding cable from the battery negative terminal to a metal member of the frame to ensure a good ground.
10. Connect the blue remote turn on-off wire in the speaker cable assembly to the deck turn on connection, power antenna or a separate on-off switch.

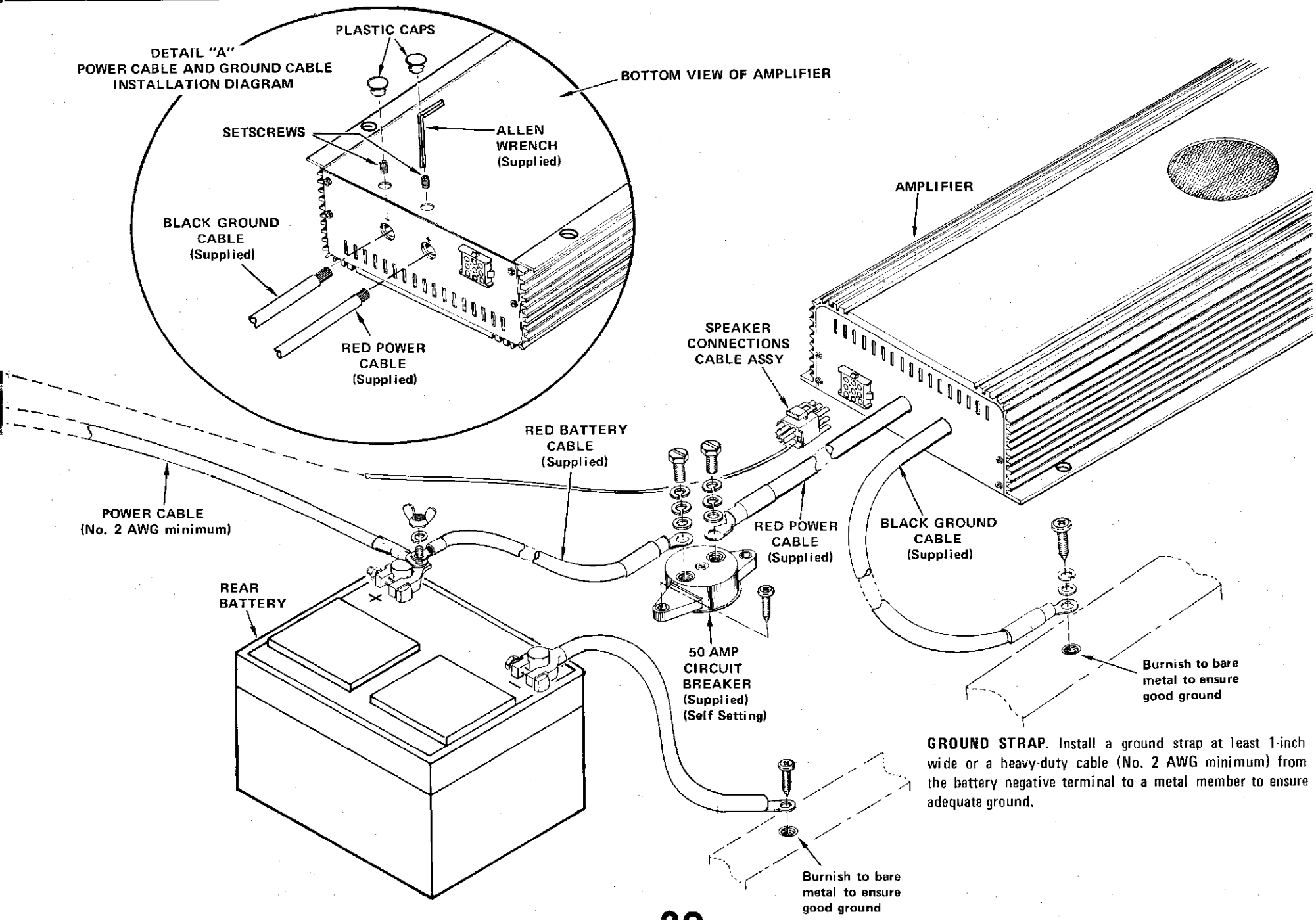



**AMPLIFIER ON-OFF CONTROL**
You may connect the remote blue lead to the power antenna or the deck turn-on connections, or install an on-off switch. Hooking the blue lead to 12 volts will not allow the amplifier to turn off.

**BLUE REMOTE TURN ON/OFF WIRE**


ENGINE COMPARTMENT BATTERY
To Engine
To Engine
150 AMP CIRCUIT BREAKER (Not supplied but can be obtained from dealer)
Burnish to bare metal to ensure good ground

**GROUND STRAP.** Install a ground strap at least 1-inch wide from the negative battery terminal to a metal member on the chassis to ensure adequate ground.




**GROUND STRAP.** Install a ground strap at least 1-inch wide or a heavy-duty cable (No. 2 AWG minimum) from the battery negative terminal to a metal member to ensure adequate ground.

# SPEAKER CONNECTIONS

## IMPEDANCE

The ORION sx Series Amplifiers are designed for operation with 2 to 16 ohm speakers. For best operation, we recommend high quality 8-ohm speakers. The efficiency of 8-ohm speakers tends to be a little better than 4-ohm speakers. You only get 3 dB gain from the increase in power by going from 8 ohms to 4 ohms. Many high quality 8-ohm subwoofers are actually 5 to 6 dB more efficient than 4-ohm subwoofers. Also, if you use 8-ohm speakers, your amplifier will run half as hot and your battery will last longer.

**NOTE:** *ORION amplifiers have an excellent damping factor. Damping factor is the reflected output impedance in the amplifier. The higher the damping factor in the amplifier, the less tendency for the speaker to move on its own, say when it is bumped. The amplifier controls the damping in the speaker.*

## CONNECTIONS

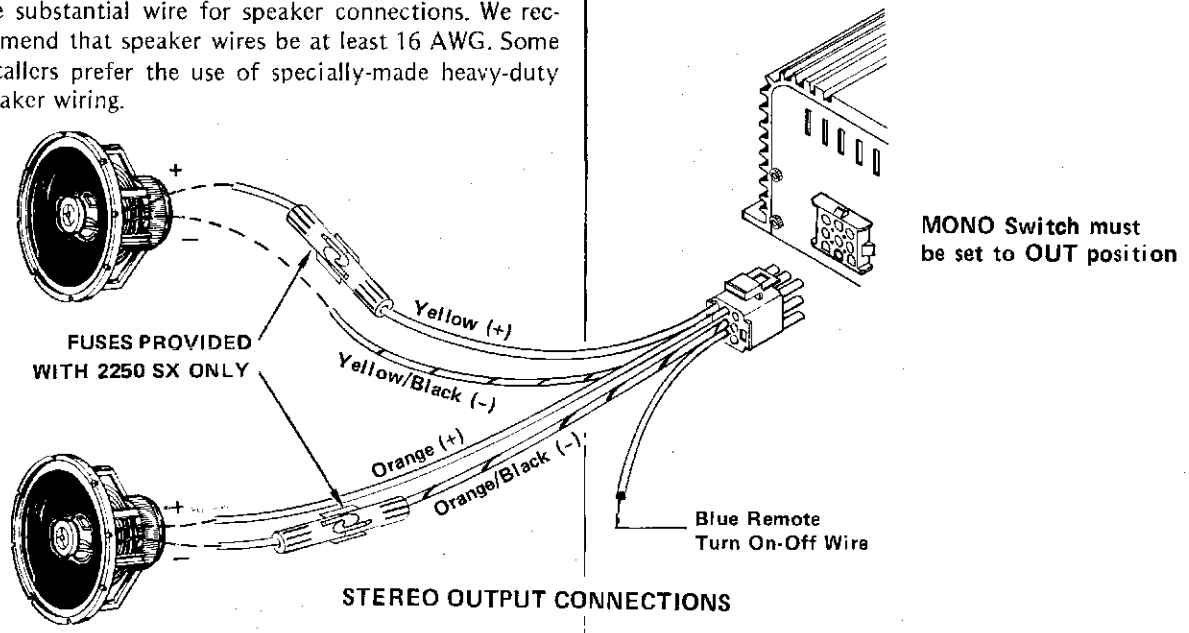
NEVER connect any speaker to chassis ground. This will introduce ground loops that cause noise in the system and, in the case of bridging, cancels out the two-phase effect.

NEVER used twisted wire connections. Always make connections using spade insulated butt connectors or quick-disconnect connectors or solder connections. If quick-disconnects or solder connections are used, insulate the connections using shrink tubing. Do not use electrician's tape since the adhesive on such tapes tends to deteriorate with time and cause short circuits. Do NOT route the speaker wires next to any power wires.

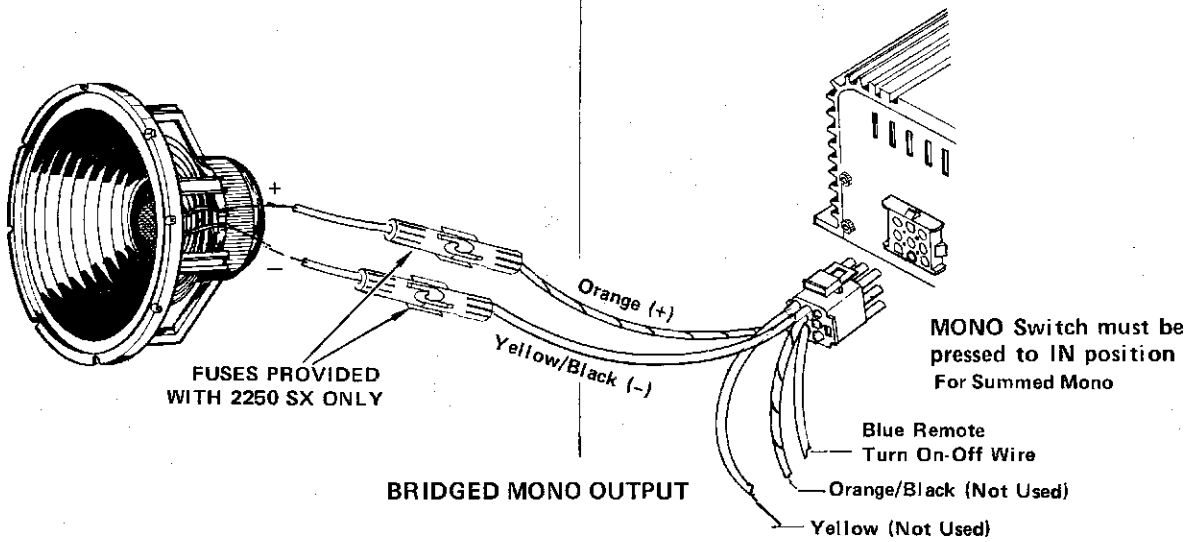
Be sure to observe the speaker polarity shown on the diagrams on this page. Except as shown and described in the connection diagrams shown in figures 1 through 11, the yellow wire is positive and the yellow/black wire is negative. Also, the orange wire is positive and the orange/black wire is negative. For bridged operation, the orange wire is positive and the yellow/black wire is negative. The yellow and orange/black wires are not used.

## SPEAKER WIRE

Use substantial wire for speaker connections. We recommend that speaker wires be at least 16 AWG. Some installers prefer the use of specially-made heavy-duty speaker wiring.




STEREO OUTPUT CONNECTIONS




BRIDGED MONO OUTPUT

# SYSTEM ADJUSTMENTS

**IMPORTANT: You will get less system noise if you keep the amplifier gain as low as possible.**

IF THERE ARE NO ACCESSORIES (equalizers, crossovers, etc.) used in the system:

1. Turn all power off.
2. If the Bridging Mode is being used, press the MONO switch to the IN position. If the Bridging Mode is not being used, make sure the MONO switch is in the OUT position.
3. Set the GAIN controls on all amplifiers to their minimum position.
4. Turn on power to the amplifiers. Turn on the radio and set the VOLUME control for approximately 3/4 volume.
5. Adjust the GAIN control on each amplifier until the PK indicators just flash on (clipping).
6. Set the VOLUME control on the radio for desired listening level.
7. Press the EQ switch to the IN position.

IF ORION ACCESSORIES ARE BEING USED

If you are adjusting a system containing ORION accessories, refer to the adjustment procedures contained in each applicable ORION accessory manual.

In general, make adjustments as follows:

1. Turn all power off.
2. Set the gain controls on all amplifiers to their minimum positions.
3. If an ORION 200 DAB Dual Amp Balancer is installed in the system, set both fader controls to maximum (fully clockwise).
4. Set all frequency controls on the 300 PRQ or 600 EQM Equalizers to flat response (dots in top center position).

   If a 500 PMQ Parametric Equalizer is being used, set the frequency controls to the center position and set the boost/cut controls to the center position.
5. If a 600 EQM is being used, set the input gain control to minimum (fully counterclockwise).

   If a 300 PRQ or 500 PMQ is being used, set both input controls to minimum (fully counterclockwise) and the VOLUME control for maximum (fully clockwise).
6. Turn on power to the amplifiers. Turn on the radio and set the VOLUME control for approximately 3/4 volume.
7. If a 600 EQM is being used, adjust the input gain control clockwise until the PK indicators on the amplifiers just start to flash (clipping). If the gain control on the 600 EQM does not provide full volume, increase the gain setting of each amplifier just enough to cause the PK indicators to flash.

   If a 300 PRQ or 500 PMQ is being used, adjust each input gain control until the PK indicators on the amplifiers just start to flash (clipping). If the input gain controls on the 300 PRQ or 500 PMQ do not produce full volume, increase the gain setting of each amplifier as required to cause the PK indicators to flash. Decrease the setting of the VOLUME control on the 300 PRQ or 500 PMQ to desired listening level.

   **CAUTION:** *Be sure to turn off the power when disconnecting and reconnecting cables.*
8. If a 200 CRX Active Crossover is installed in the system, unplug the cable from the *low output* and adjust the HIGH FREQ control to where the mid-range and highs sound best. Then plug in the *low output* cable and unplug the high output cable. Using the LOW FREQ control, adjust the lows until sound good to you. Now plug in the high output and make minor adjustments to suit your taste.

If a 300 CRX 3-Way Active Crossover is installed in the system, proceed as follows:

NOTE: *Ideally, the LOW OUT should be adjusted to permit the subwoofers to reproduce all frequencies of 100 to 150 Hz and below. The HIGH OUT should be adjusted to permit the tweeters to reproduce only frequencies of about 4 kHz and above. The MID OUT should be adjusted to pass a band of frequencies of about 100 Hz to 4500 Hz. The response of the various speakers greatly affects these adjustments, however, so it is generally always better to trust your ears and simply adjust the various frequency outputs to where they sound best to you.*

a. Unplug the cables from the MID OUT and HIGH OUT connectors and adjust the LOW PASS control until the lows from the subwoofers sound good to you.

b. Unplug the cable from the LOW OUT connector and plug in the HIGH OUT cable. Adjust the HIGH PASS control to where the highs from the tweeters sound best.

c. Unplug the cable from the HIGH OUT connector and plug in the MID OUT cable. Adjust MID PASS controls until the instruments and voice sounds delivered by the mid-range speakers sound the fullest. Use the left-hand MID PASS control to adjust the low end and the right-hand MID PASS control to adjust the high end.

d. Now plug in the HIGH OUT and LOW OUT cables and make minor adjustments to suit your taste.